



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

STANDARD LOW BID PROJECT

February 2, 2007

HEAT PLANT FUEL TANK AND GENERATOR REPLACEMENT

**SOUTHERN UTAH UNIVERSITY
CEDAR CITY, UTAH**

DFCM Project Number 06127730

WHW Engineering
1354 East 3300 South #200
Salt Lake City, Utah 84106

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Fairpark Map

Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at <http://dfcm.utah.gov> or are available upon request from DFCM.

DFCM General Conditions dated May 25, 2005.

DFCM Application and Certification for Payment dated May 25, 2005.

Technical Specifications :

Drawings:

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at <http://dfcm.utah.gov>

NOTICE TO CONTRACTORS

Sealed bids will be received by the Division of Facilities Construction and Management (DFCM) for:

HEAT PLANT FUEL TANK AND GENERATOR REPLACEMENT
SOUTHERN UTAH UNIVERSITY – CEDAR CITY, UTAH
DFCM PROJECT NO: 06127730

Bids will be in accordance with the Contract Documents that will be available at 3:00 PM on Friday, February 2, 2007, and distributed in electronic format only on CDs from DFCM, 4110 State Office Building, Salt Lake City, Utah and on the DFCM web page at <http://dfcm.utah.gov>. For questions regarding this project, please contact Jeff Reddoor, DFCM, at 801-971-9830. No others are to be contacted regarding this bidding process. The construction budget for this project is \$327,000.00

A **mandatory** pre-bid meeting will be held at 1:30 PM on Thursday, February 8, 2007 at the SUU Physical Plant Building in Cedar City, Utah. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 2:00 PM on Wednesday, February 21, 2007 at the Wasatch Building at the Utah State Fairpark, approximately 155 North 1000 West, Salt Lake City, Utah. Refer to the map on the DFCM website for directions (http://dfcm.utah.gov/downloads/fairpark_map.pdf). Bids will be opened and read aloud in the Wasatch Building at the Utah State Fairpark. NOTE: Bids must be received at the Wasatch Building at the Utah State Fairpark by the specified time.

A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

The Division of Facilities Construction and Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of DFCM.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
Marla Workman, Contract Coordinator
4110 State Office Building, Salt Lake City, Utah 84114

PROJECT DESCRIPTION

Provide two new underground fuel oil storage tanks 15,000 gallons each complete with pumps, piping, and burner change out of number two boiler; install one new 500 KW emergency generator complete with transfer switch conduit and all electrical wiring and related components; and asphalt repair over new tanks.



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

PROJECT SCHEDULE

| PROJECT NAME: HEAT PLANT FUEL TANK AND GENERATOR REPLACEMENT SOUTHERN UTAH UNIVERSITY – CEDAR CITY, UTAH | | | | |
|---|------------|-------------------|-------------|--|
| DFCM PROJECT NO. 06127730 | | | | |
| Event | Day | Date | Time | Place |
| Bidding Documents Available | Friday | February 2, 2007 | 3:00 PM | DFCM 4110 State Office Bldg SLC, UT or DFCM web site * |
| Mandatory Pre-bid Site Meeting | Thursday | February 8, 2007 | 1:30 PM | Physical Plant Building Southern Utah University Cedar City, UT |
| Last Day to Submit Questions | Tuesday | February 13, 2007 | 3:00 PM | Jeff Reddoor – DFCM E-mail JREDDOOR@utah.gov |
| Addendum Issued Responding to Questions (if needed) | Thursday | February 15, 2007 | 3:00 PM | DFCM web site * |
| Prime Contractors Turn In Bid and Bid Bond | Wednesday | February 21, 2007 | 2:00 PM | Wasatch Building Utah State Fairpark Approx 155 North 1000 West Salt Lake City, UT ** |
| Sub-contractor List Due | Thursday | February 22, 2007 | 2:00 PM | DFCM 4110 State Office Bldg SLC, UT Fax 801-538-3677 |
| Substantial Completion Date | Monday | December 31, 2007 | 5:00 PM | |

* **NOTE:** DFCM's web site address is <http://dfcm.utah.gov>

** **Due to the ongoing construction on Capitol Hill and the anticipated shortage of parking during 2007, all bids will be received and opened at the Wasatch Building at the Utah State Fairpark. Refer to map on the DFCM web site for directions (http://dfcm.utah.gov/downloads/fairpark_map.pdf)**



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

BID FORM

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **HEAT PLANT FUEL TANK AND GENERATOR REPLACEMENT – SOUTHERN UTAH UNIVERSITY – CEDAR CITY, UTAH – DFCM PROJECT NO. 06127730** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

_____ DOLLARS (\$_____) (In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **December 31, 2007**, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **\$ 500.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____.

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract.

The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable 100% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization:

(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

Respectfully submitted,

Name of Bidder

ADDRESS:

Authorized Signature

INSTRUCTIONS TO BIDDERS

1. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Invitation to Bid.

2. Bids

Before submitting a bid, each contractor shall carefully examine the Contract Documents, shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Invitation to Bid prior to the deadline for submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. **THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.**

If the bid bond security is submitted on a bid bond form other than DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. **NOTE: A cashier's check cannot be used as a substitute for a bid bond.**

3. Contract and Bond

The Contractor's Agreement will be in the form found in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the contract sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for subcontractors will be specified in the Supplementary General Conditions.

4. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the “Instructions and Subcontractor’s List Form”, which are included as part of these Contract Documents. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

5. Interpretation of Drawings and Specifications

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Project Manager a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by addenda posted on DFCM’s web site at <http://dfcm.utah.gov>. Neither the DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

6. Addenda

Addenda will be posted on DFCM’s web site at <http://dfcm.utah.gov>. Contractors are responsible for obtaining information contained in each addendum from the web site. Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda may result in disqualification from bidding.

7. Award of Contract

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

8. DFCM Contractor Performance Rating

As a contractor completes each DFCM project, DFCM, the architect/engineer and the using agency will evaluate project performance based on the enclosed “DFCM Contractor Performance Rating” form. The ratings issued on this project will not affect this project but may affect the award on future projects.

9. Licensure

The Contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

10. Right to Reject Bids

DFCM reserves the right to reject any or all Bids.

11. Time is of the Essence

Time is of the essence in regard to all the requirements of the Contract Documents.

12. Withdrawal of Bids

Bids may be withdrawn on written request received from bidder prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

13. Product Approvals

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

14. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the contractor, subcontractor or sub-subcontractor.

15. Debarment

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by DFCM as part of the requirements for award of the Project.

BID BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of \$ _____ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the _____ Project.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

PROVIDED, HOWEVER, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

DATED this _____ day of _____, 20_____.

Principal's name and address (if other than a corporation):

By: _____

Title: _____

Principal's name and address (if a corporation):

By: _____

Title: _____
(Affix Corporate Seal)

Surety's name and address:

By: _____
Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
COUNTY OF _____) ss.

On this ____ day of _____, 20_____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My Commission Expires: _____

Resides at: _____

Agency: _____
Agent: _____
Address: _____
Phone: _____

NOTARY PUBLIC

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

**Division of Facilities Construction and****INSTRUCTIONS AND SUBCONTRACTORS LIST FORM**

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, on the following basis:

PROJECTS UNDER \$500,000 - ALL SUBS \$20,000 OR OVER MUST BE LISTED
PROJECTS \$500,000 OR MORE - ALL SUBS \$35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- Bidder must list "Self" if performing work itself.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

BIDDER LISTING 'SELF' AS PERFORMING THE WORK:

Any bidder that is properly licensed for the particular work and intends to perform that work itself in lieu of a subcontractor that would otherwise be required to be on the subcontractor list, must insert the term 'Self' for that category on the subcontractor list form. Any listing of 'Self' on the sublist form shall also include the amount allocated for that work.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A. Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM
Page No. 2

GROUND FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

- (1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
- (2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
- (3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
- (4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
- (5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
- (6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

| TYPE OF WORK | SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION" | SUBCONTRACTOR BID AMOUNT | CONT. LICENSE # |
|-------------------------|---|-----------------------------|--|
| ELECTRICAL | ABCD Electric Inc. | \$350,000.00 | 123456789000 |
| LANDSCAPING | "Self" | 300,000.00 | 123456789000 |
| CONCRETE (ALTERNATE #1) | XYZ Concrete Inc | 298,000.00 | 987654321000 |
| MECHANICAL | "Special Exception" (attach documentation) | Fixed at: 350,000.00 | (TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR) |

**PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS
SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.**

**SUBCONTRACTORS LIST**

FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

| TYPE OF WORK | SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION" | SUBCONTRACTOR BID AMOUNT | CONT. LICENSE # |
|--------------|---|-----------------------------|-----------------|
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We certify that:

1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____

SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR DFCMS REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY DFCM. ATTACH A SECOND PAGE IF NECESSARY.

FUGITIVE DUST PLAN

The Contractor will fill out the form and file the original with the Division of Air Quality and a copy of the form with the Division of Facilities Construction & Management, prior to the issuance of any notice to proceed.

The Contractor will be fully responsible for compliance with the Fugitive Dust Control Plan, including the adequacy of the plan, any damages, fines, liability, and penalty or other action that results from noncompliance.

Utah Division of Air Quality

April 20, 1999

**GUIDANCE THAT MUST BE CONSIDERED IN DEVELOPING AND SUBMITTING A
DUST CONTROL PLAN FOR COMPLIANCE WITH R307-309-3, 4, 5, 6, 7**

Source Information:

1. Name of your operation (source): provide a name if the source is a construction site.
2. Address or location of your operation or construction site.
3. UTM coordinates or Longitude/Latitude of stationary emission points at your operation.
4. Lengths of the project, if temporary (time period).
5. Description of process (include all sources of dust and fugitive dust). Please, if necessary, use additional sheets of paper for this description. Be sure to mark it as an attachment.
6. Type of material processed or disturbed.
7. Amount of material processed (tons per year, tons per month, lbs./hr., and applicable units).

8. Destination of product (where will the material produced be used or transported, be specific, provide address or specific location), information needed for temporary relocation applicants.
9. Identify the individual who is responsible for the implementation and maintenance of fugitive dust control measures. List name(s), position(s) and telephone number(s).
10. List, and attach copies of any contract lease, liability agreement with other companies that may, or will, be responsible for dust control on site or on the project.

Description of Fugitive Dust Emission Activities
(Things to consider in addressing fugitive dust control strategies.)

1. Type of activities (drilling and blasting, road construction, development construction, earth moving and excavation, handling and hauling materials, cleaning and leveling, etc).
2. List type of equipment generating the fugitive dust.
3. Diagram the location of each activity or piece of equipment on site. Please attach the diagram.
4. Provide pictures or drawings of each activity. Include a drawing of the unpaved/paved road network used to move loads “on” and “off” property.
5. Vehicle miles travels on unpaved roads associated with the activity (average speed).
6. Type of dust emitted at each source (coal, cement, sand, soil, clay, dust, etc.)
7. Estimate the size of the release area at which the activity occurs (square miles). For haul or dirt roads include total miles of road in use during the activity.

Description of Fugitive Dust Emission Controls on Site

Control strategies must be designed to meet 20% opacity or less on site (a lesser opacity may be defined by Approval Order conditions or federal requirements such as NSPS), and control strategies must prevent exceeding 10% opacity from fugitive dust at the property boundary (site boundary) for compliance with R307-309-3.

1. Types of ongoing emission controls proposed for each activity, each piece of equipment, and haul roads.
2. Types of additional dust controls proposed for bare, exposed surfaces (chemical stabilization, synthetic cover, wind breaks, vegetative cover, etc).
3. Method of application of dust suppressant.
4. Frequency of application of dust suppressant.
5. Explain what triggers the use of a special control measure other than routine measures already in place, such as covered loads or measures covered by a permit condition (increase in opacity, high winds, citizen complaints, dry conditions, etc).
6. Explain in detail what control strategies/measures will be implemented off-hours, i.e., Saturdays/Sundays/Holidays, as well as 6 PM to 6 AM each day.

Description of Fugitive Dust Control Off-site

Prevent, to the maximum extent possible, deposition of materials, which may create fugitive dust on public and private paved roads in compliance with R307-309-5, 6, 7.

1. Types of emission controls initiated by your operation that are in place “off” property (application of water, covered loads, sweeping roads, vehicle cleaning, etc.).

2. Proposed remedial controls that will be initiated promptly if materials, which may create fugitive dust, are deposited on public and private paved roads.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Fugitive Dust Control Plan Violation Report

When a source is found in violation of R307-309-3 or in violation of the Fugitive Dust Control Plan, the source must submit a report to the Executive Secretary within 15 days after receiving a Notice of Violation. The report must include the following information:

1. Name and address of dust source.
2. Time and duration of dust episode.
3. Meteorological conditions during the dust episode.
4. Total number and type of fugitive dust activities and dust producing equipment within each operation boundary. If no change has occurred from the existing dust control plan, the source should state that the activity/equipment is the same.
5. Fugitive dust activities or dust producing equipment that caused a violation of R-307-309-3 or the source's dust control plan.
6. Reasons for failing to control dust from the dust generating activity or equipment.
7. New and/or additional fugitive dust control strategies necessary to achieve compliance with R307-309-3, 4, 5, 6, or 7.
8. If it can not be demonstrated that the current approved Dust Control Plan can result in compliance with R307-309-3 through 7, the Dust Control Plan must be revised so as to demonstrate compliance with 307-309-3 through 7. Within 30 days of receiving a fugitive dust Notice of Violation, the source must submit the revised Plan to the Executive Secretary for review and approval.

Submit the Dust Control Plan to:

| | |
|---------------------------------|-----------------------|
| Executive Secretary | Phone: (801) 536-4000 |
| Utah Air Quality Board | FAX: (801) 536-4099 |
| POB 144820 | |
| 15 North 1950 West | |
| Salt Lake City, Utah 84114-4820 | |

Attachments: DFCM Form FDR R-307-309, Rule 307-309

CONTRACTOR'S AGREEMENT

FOR:

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____"

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ DOLLARS AND NO CENTS (\$_____.00), which is the base bid, and which sum also includes the cost of a 100% Performance Bond and a 100%

CONTRACTOR'S AGREEMENT
PAGE NO. 2

Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete by _____. Contractor agrees to pay liquidated damages in the amount of \$_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Invitation to Bid, Instructions to Bidders/ Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the Contractor requests payment and agrees to

safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

CONTRACTOR'S AGREEMENT
PAGE NO. 5

IN WITNESS WHEREOF, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

CONTRACTOR: _____

Signature Date

Title: _____

State of _____)
County of _____)

Please type/print name clearly

On this ____ day of _____, 20____, personally appeared before me, _____, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the _____ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

(SEAL)

Notary Public

My Commission Expires _____

APPROVED AS TO AVAILABILITY
OF FUNDS:

David D. Williams, Jr. Date
DFCM Administrative Services Director

**DIVISION OF FACILITIES
CONSTRUCTION AND MANAGEMENT**

- Manager Date
Capital Development/Improvements

APPROVED AS TO FORM:
ATTORNEY GENERAL
November 30, 2006
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

Division of Finance Date

PERFORMANCE BOND
(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee," in the amount of _____ DOLLARS (\$ _____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ Dollars (\$ _____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

PRINCIPAL:

By: _____
(Seal)

Title: _____

WITNESS OR ATTESTATION:

SURETY:

By: _____
Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.

My commission expires: _____

Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____ authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars (\$ _____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ Dollars (\$ _____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, 1953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

PRINCIPAL:

By: _____
(Seal)

Title: _____

WITNESS OR ATTESTATION:

SURETY:

STATE OF _____)
) ss.
COUNTY OF _____)

By: _____
Attorney-in-Fact (Seal)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.

My commission expires: _____

Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General



Division of Facilities Construction and Management

CHANGE ORDER # _____

CONTRACTOR: _____

AGENCY OR INSTITUTION: _____

PROJECT NAME: _____

PROJECT NUMBER: _____

CONTRACT NUMBER: _____

ARCHITECT: _____

DATE: _____

| CONSTRUCTION CHANGE DIRECTIVE NO. | PROPOSAL REQUEST NO. | AMOUNT | | DAYS | |
|---|----------------------------|----------|----------|----------|----------|
| | | INCREASE | DECREASE | INCREASE | DECREASE |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| | Amount | Days | Date |
|------------------------------|--------|------|------|
| ORIGINAL CONTRACT | | | |
| TOTAL PREVIOUS CHANGE ORDERS | | | |
| TOTAL THIS CHANGE ORDER | | | |
| ADJUSTED CONTRACT | | | |

DFCM and Contractor agree that the terms, contract sum, scope of the Work and time specified in this Change Order shall constitute the full accord and satisfaction, and complete adjustment to the Contract and includes all direct and indirect costs and effects related to, incidental to, and/or reasonably implied from such change in the contract terms, sum, scope of the Work and time.

Contractor: _____

Date

Architect/Engineer: _____

Date

Agency or Institution: _____

Date

DFCM: _____

Date

Funding Verification: _____

Date

Page ____ of ____ page(s)

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**Division of Facilities Construction and Management****DFCM****CERTIFICATE OF SUBSTANTIAL COMPLETION**PROJECT _____ PROJECT NO: _____
AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

The Owner acknowledges receipt of the following closeout and transition materials:

☐ As-built Drawings ☐ O & M Manuals ☐ Warranty Documents ☐ Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of _____ (Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within _____ calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: \$ _____. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

_____ by: _____
CONTRACTOR (include name of firm) (Signature) DATE

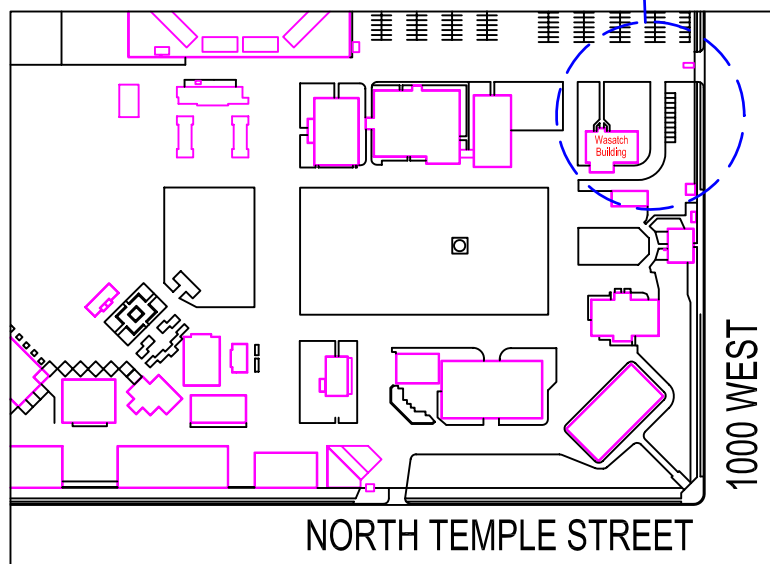
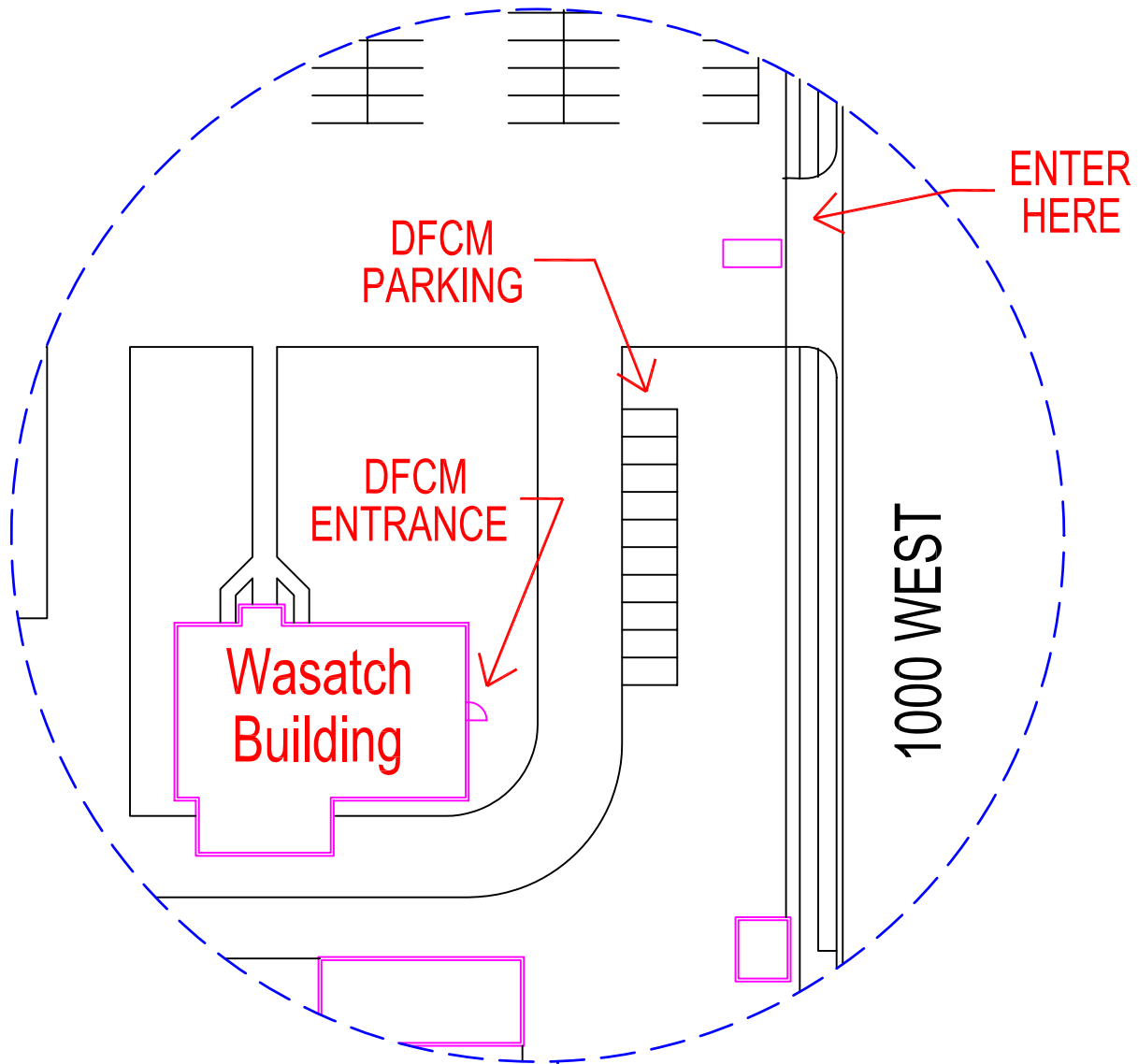
_____ by: _____
A/E (include name of firm) (Signature) DATE

_____ by: _____
USING INSTITUTION OR AGENCY (Signature) DATE

_____ by: _____
DFCM (Owner) (Signature) DATE

4110 State Office Building, Salt Lake City, Utah 84114 cc:
telephone 801-538-3018 • facsimile 801-538-3267 • <http://dfcm.utah.gov>

Parties Noted
DFCM, Director



UTAH STATE
FAIR PARK



DFCM Temporary Location

SOUTHERN UTAH UNIVERSITY HEAT PLANT FUEL TANK & GENERATOR REPLACEMENT

DFCM PROJECT # 06127730



State of Utah—Department of Administrative Services

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

4110 State Office Building / Salt Lake City, Utah 84114 / 538-3018

SPECIFICATIONS

PREPARED BY

**WHW ENGINEERING INC.
1354 EAST 3300 SOUTH, SUITE 200
SALT LAKE CITY, UTAH 84106
PHONE: (801) 466-4021
FAX: (801) 466-8536**

December 2006

WHW Engineering Project # 06024

DIVISION 0 - BIDDING AND CONTRACTING REQUIREMENTS

00320 GEOTECHNICAL DATA

DIVISION 1 - GENERAL REQUIREMENTS

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01200 DEFINITIONS AND STANDARDS
01300 PROCEDURES AND CONTROLS
01310 PROJECT MANAGEMENT AND COORDINATION
01330 SUBMITTAL PROCEDURES
01732 SELECTIVE DEMOLITION
01770 CLOSEOUT PROCEDURES
01781 PROJECT RECORD DOCUMENTS

DIVISION 2 - SITEWORK

02230 SITE CLEARING
02260 EXCAVATION SUPPORT AND PROTECTION
02300 EARTHWORK
02741 HOT MIX ASPHALT PAVING
02900 LANDSCAPING

DIVISION 3 - CONCRETE

03300 CAST-IN-PLACE CONCRETE

DIVISION 4 - MASONRY

04810 UNIT MASONRY ASSEMBLIES

DIVISION 9 - FINISHES

09900 PAINTING

DIVISION 15 - MECHANICAL

15010 GENERAL REQUIREMENTS
15077 IDENTIFICATION FOR FUEL OIL PIPING AND EQUIPMENT

- 15126 METERS AND GAGES FOR FUEL OIL PIPING
- 15192 FACILITY FUEL-OIL PIPING
- 15512 OIL BURNER MODIFICATIONS

DIVISION 16 - ELECTRICAL

- 16001 ELECTRICAL GENERAL PROVISIONS
- 16070 ELECTRICAL CONNECTIONS FOR EQUIPMENT
- 16080 DEMOLITION
- 16110 CONDUIT RACEWAYS
- 16120 CONDUCTORS AND CABLES
- 16135 ELECTRICAL BOXES AND FITTINGS
- 16136 SUPPORTING DEVICES
- 16155 MOTOR STARTERS
- 16170 MOTOR AND CIRCUIT DISCONNECTS
- 16180 OVERCURRENT PROTECTIVE DEVICES
- 16452 GROUNDING
- 16610 EMERGENCY ELECTRICAL SYSTEMS

DIVISION 0
BIDDING AND CONTRACTING REQUIREMENTS

00320 GEOTECHNICAL DATA

SECTION 00320 - GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Geotechnical investigation report prepared by Applied Geotechnical Engineering Consultants, Inc. (AGEC).
- B. Inclusion of soils investigation is for contractor information only, and is not part of the contract documents. Recommendations and provisions of the Geotechnical Investigation apply to work of this contract. The Contractor is responsible for all requirements and provisions either outlined on the drawings or detailed in the Geotechnical Investigation, except for fill materials that are noted on the drawings.

1.2 REPORT

- A. Report dated October 10, 2006 is included at the end of this section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 00320

GEOTECHNICAL INVESTIGATION

**SOUTHERN UTAH UNIVERSITY
HEAT PLANT UNDERGROUND STORAGE TANKS
CEDAR CITY, UTAH**

PREPARED FOR:

**WHW ENGINEERING
1354 EAST 3300 SOUTH
SALT LAKE CITY, UTAH 84106**

ATTENTION: WIN PACKER, P.E.

PROJECT NO. 2061959

OCTOBER 10, 2006

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| Summary of Laboratory Test Results | Table 1 |

SUMMARY

1. The subsurface profile observed within the boring drilled at the site generally consists of asphalt and base course underlain by silty sand with gravel overlying lean clay. The lean clay is underlain by silty clayey sand with gravel to the maximum depth investigated, approximately 26 feet.
2. Groundwater was not encountered within the boring to the maximum depth investigated, approximately 26 feet.
3. Laboratory testing indicates the natural soils are slightly collapsible to a depth of approximately 25 feet when wetted under a constant pressure of approximately 1,000 psf.
4. The proposed tanks may be supported on undisturbed natural soil provided the owner is willing to accept the risk of potential differential settlement of the tanks if the natural collapsible soil below the tanks is wetted. If desired, overexcavation and replacement of the full depth or a portion of the collapsible soil may be conducted to reduce the risk of potential settlement due to densification of the collapsible soil. A table with estimated settlement based on depth of overexcavation and replacement of the collapsible soil is provided in the Site Grading section of this report.
5. Positive drainage is critical to reduce the potential of the underlying moisture-sensitive sand to be wetted which would result in tank settlement. The drainage recommendations in this report should be referenced and followed throughout the life of the structures.
6. The structure should be designed and constructed in accordance with a soil profile of "Site Class D" in accordance with the 2003 International Building Code. Subsurface soils at the site are non-liquefiable during a severe seismic event.
7. Detailed recommendations for subgrade preparation, pavements, materials, tank support, and drainage are included in the report.
8. The information provided in this summary should not be used independent of that provided in the body of this report.

SCOPE OF WORK

This report presents the results of a geotechnical investigation for the proposed underground storage tanks to be constructed near the Southern Utah University Heat Plant building in Cedar City, Utah at the approximate location shown on Figure 1. This report presents the subsurface conditions encountered, laboratory test results, and recommendations for the geotechnical aspects of the project.

Field exploration was conducted to obtain information on the subsurface conditions and to obtain samples for laboratory testing. Samples obtained during the field investigation were tested in the laboratory to determine physical and engineering characteristics of the on-site soil. Results of the field exploration and laboratory tests were analyzed to develop recommendations for the proposed construction.

This report has been prepared to summarize the data obtained during the study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction are included in the report.

SITE CONDITIONS

The area where the tanks are proposed to be constructed is a paved parking area adjacent to the heat plant building. The area generally slopes down gently to the west. Existing buildings are located to the north, south, and east. Additional paved parking is to the west.

FIELD STUDY

On September 12, 2006, an engineer from AGECE visited the site and observed the drilling of one boring at the approximate location shown on Figure 2. The boring was drilled with a truck mounted drill rig equipped with 7-inch hollow-stem augers.

SUBSURFACE CONDITIONS

The subsurface profile observed within the boring drilled at the site generally consists of asphalt and base course underlain by silty sand with gravel overlying lean clay. The lean clay is underlain by silty clayey sand with gravel to the maximum depth investigated, approximately 26 feet.

Detailed descriptions of soil types encountered within the boring follow.

Asphalt - The asphalt is in good condition and is black in color.

Base Course - The base course appears to be moderately compacted, dry to slightly moist, and brown in color.

Lean clay - The lean clay is medium stiff, moist, medium plastic, and brown in color.

Laboratory tests conducted on samples of the lean clay indicate an in-place moisture content of 22 percent, an in-place dry density of 96 pcf, and a fines content (percent passing the No. 200 sieve) of 96 percent. An Atterberg Limits test indicates a liquid limit of 28 percent and a plasticity index of 11 percent. A water soluble sulfate test indicates a sulfate concentration of 5,400 ppm. A resistivity test indicates a resistivity of 900 ohm-cm. A pH test indicates a value of 8.0.

Silty clayey sand with gravel - The silty clayey sand with gravel is medium dense to dense, slightly moist to moist, fine-grained, and brown to red in color.

Laboratory tests conducted on samples of the silty clayey sand indicate in-place moisture contents ranging from 4 to 10 percent, in-place dry densities ranging from 112 to 120 pcf, and fines contents (percent passing the No. 200 sieve) ranging from 11 to 45 percent. Atterberg Limits tests indicate liquid limits ranging from 19 to 20 percent and a plasticity index of 5 percent.

One-dimensional consolidation/collapse tests conducted on samples of the silty clayey sand indicate it is non-moisture sensitive to slightly collapsible when wetted under a constant pressure of 1,000 psf. A collapse potential of approximately 2 percent was measured. The collapse potential appears to decrease with depth.

Silty sand with gravel - The silty sand with gravel is medium dense, dry to slightly moist, fine-grained, and brown in color.

The Logs, Legend and Notes of the Exploratory Boring are shown on Figure 3. The laboratory test results are also shown on Figure 3 and are summarized in the Summary of Laboratory Test Results, Table 1. The consolidation/collapse test results are shown graphically on Figures 4 and 5.

SUBSURFACE WATER

Groundwater was not encountered within the boring to the maximum depth investigated, approximately 26 feet. Fluctuations in the groundwater level may occur over time. An evaluation of such fluctuations is beyond the scope of this report.

PROPOSED CONSTRUCTION

We understand it is proposed to place two steel underground storage tanks at the site. We understand the tanks will be 12 feet in diameter and 25 feet in length. We anticipate that the bottom of the tank excavation will extend approximately 15 feet below the existing grade.

We anticipate that the asphaltic concrete parking lot in the area of the proposed tanks will be reconstructed. We also anticipate that underground utilities will be constructed as part of the project.

If the proposed construction or grading are significantly different from what is described above, we should be notified so we may reevaluate our recommendations.

RECOMMENDATIONS

Based on our experience in the area, conditions observed, and laboratory test results, the following recommendations are provided for the proposed construction:

A. Site Grading

1. Subgrade Preparation

Prior to placing fill or the tanks, the exposed subgrade should be scarified to a depth of at least 8 inches, properly moisture conditioned and compacted to meet the recommendations in the compaction section of this report.

Due to the presence of slightly collapsible soil at the site, we estimate there is the potential for up to approximately 2½ inches of additional differential settlement should the natural collapsible soil below the proposed tank become wet. We anticipate the tanks and piping can be designed and constructed to withstand this amount of settlement. If this risk is not acceptable to the owner

and builder, the full depth or a portion of the collapsible soil should be overexcavated and replaced in properly compacted lifts. Estimated potential differential settlement for various overexcavation depths is provided in the following table.

| Depth of Overexcavation Below Existing Grade (feet) | Estimated Potential Differential Settlement* (inches) |
|---|---|
| 15 | 2 ½ |
| 17 | 2 |
| 19 | 1 ½ |
| 21 | 1 |
| 23 | ½ |
| 25 | < ½ |

* In addition to the settlement estimate provided in Tank Support section.

2. Excavation/Earthwork

Excavation of the soils at the site can be accomplished with typical excavation equipment.

3. Material Suitability

The on-site soils are suitable for use as site grading fill, tank backfill, and utility trench backfill, and structural fill below the tank.

4. Imported Materials

Import materials should have low solubility and meet the following criteria for materials used in the listed condition. AGECE should approve imported materials prior to use on-site.

| Area | Fill Type | Recommendations |
|---------------------------------|--------------|---|
| Tank Excavation | Site Grading | -200 < 50%, LL < 30% Maximum size: 4 inches Solubility < 1% |
| Under slabs (upper 4 inches) | Base Course | -200 < 12% Maximum size: 1 inch |

-200 = Percent Passing the No. 200 Sieve
LL = Liquid Limit

5. Compaction

Compaction of fill placed at the site should equal or exceed the following percentages of the maximum dry densities as determined by ASTM D-1557:

| Area to Support | Percent Compaction (D-1557) |
|--------------------------|-----------------------------------|
| Subgrade | 90 |
| Site grading fill | 95 |
| Tank excavation backfill | 95 |
| Utility trench backfill | 95 |

Fill placed at the site should be frequently tested to verify proper compaction. Fill should be placed in lift thicknesses which do not exceed the capability of the compaction equipment utilized. Generally, lift thicknesses of 6 to 8 inches are adequate. Lift thicknesses should be reduced to 4 inches for hand compaction equipment.

To facilitate compaction of granular site grading fill, the moisture content should be within ± 2 percentage points of the optimum moisture content as determined by ASTM D-1557 prior to compaction. Fine-grained fill should be moisture conditioned to 0 to 2 percentage points over the optimum moisture content.

6. Drainage

Due to the moisture sensitive characteristics of the underlying natural soil, positive site drainage is critical and should be maintained through the course of construction and during the life of the structure. Positive site drainage away from the tanks and pavement should be maintained. In no case should water be allowed to accumulate adjacent to the tanks.

B. **Tank Support**

The proposed tanks may be supported on undisturbed natural soil provided the owner is willing to accept the risk of potential differential settlement of the tanks if the natural collapsible soil below the tanks is wetted. If desired, overexcavation and replacement of the full depth or a portion of the collapsible soil may be conducted to reduce the risk of potential settlement due to densification of the collapsible soil. A table with estimated settlement based on depth of overexcavation and replacement of the collapsible soil is provided in the Site Grading section of this report.

Based on the subsoil conditions encountered and the anticipated tank loads, we estimate total settlement to be less than 1 inch and differential settlement to be approximately ½ inch. Additional differential settlement of approximately 2 ½ inches may occur if the underlying collapsible soil is wetted.

C. **Concrete Slab-on-grade**

1. Slab Support

Concrete slabs may be supported on properly compacted structural fill. The thickness of structural fill should be selected by the owner based on their level of acceptable risk. Fill placed in slab areas should be tested frequently to verify compaction meets the recommendations provided within this report.

2. Underslab Base Course

A 4-inch layer of properly compacted base course should be placed below slabs to provide a firm and consistent subgrade and promote even curing of the concrete.

D. **Lateral Earth Pressures**

The following equivalent fluid weights are given for design of tanks and walls backfilled with on-site soil. The active condition is where the wall moves away from the soil and the passive is where the wall moves into the soil. The at-rest condition is where the wall does not move.

| Condition | Equivalent Fluid Weight On-site Granular Soil (pcf) | Equivalent Fluid Weight On-site Fine-grained Soil (pcf) |
|-----------|---|---|
| Active | 35 | 45 |
| At-Rest | 55 | 65 |
| Passive | 300 | 225 |

The equivalent fluid weights given in the table should be increased by 20 pcf for the active and at-rest conditions and reduced by 20 pcf for the passive condition for seismic design. The seismic increases and decrease are based on a horizontal ground acceleration of 0.31g which represents a 2 percent probability of exceedance in a 50 year period.

It should be recognized that the above values account for the lateral earth pressures due to the soil and level backfill conditions and do not account for hydrostatic pressures. Lateral loading should be increased to account for surcharge loading if structures are placed above the tanks and are within a horizontal distance equal to the height of the tanks.

E. Soil Corrosion

Laboratory testing indicates the natural soil contains water soluble sulfates in sufficient concentrations to be corrosive to concrete. Consideration should be given to the use of cathodic protection for buried metal pipes. We recommend using Type V sulfate resistant cement in concrete that comes in contact with the natural soil/bedrock. Table 1904.3 of the 2003 International Building Code should be referenced utilizing a sulfate exposure category of "severe".

F. Seismicity/Liquefaction

The structures at the site should be designed and constructed in accordance with seismic soil profile "Site Class D" based on the 2003 International Building Code.

Based on subsurface soil groundwater conditions, the subsurface soil is non-liquefiable during a severe seismic event.

G. Pavement

Based on the subsoil conditions encountered, laboratory test results, and the assumed traffic loading, the following recommendations are provided:

1. Subgrade Support

Prior to placement of road base, the exposed subgrade should be properly prepared as recommended in the subgrade preparation section of this report. We have assumed a CBR value of 10 percent for a properly compacted silty sand subgrade.

2. Pavement Thickness

The pavement section should match the existing section which consists of approximately 3 inches of asphaltic concrete underlain by 8 inches of base

course. If rigid pavement is used it should consist of 5 inches of concrete underlain by 4 inches of base course.

3. Pavement Material

a. *Flexible Pavement (Asphaltic Concrete)*

The pavement materials should meet AASHTO and Cedar City specifications for gradation and quality. The pavement thicknesses indicated above assume that the base course is high quality material with a California Bearing Ratio (CBR) of at least 50 percent. Asphaltic concrete should have a Marshal stability of at least 1,800 pounds.

b. *Rigid Pavement (Portland Cement Concrete)*

The pavement thicknesses indicated above assume that the concrete will have a 28-day compressive strength of 4,000 psi. Concrete should be air entrained with approximately 6 percent air and should have a minimum cement content of 6 bags per cubic yard. Maximum allowable slump will depend on the method of placement but should not exceed 5 inches.

4. Jointing

Joints for concrete pavement should be laid out in a square or rectangular pattern. Joint spacings should not exceed 30 times the thickness of the slab. The depth of joints should be at least one-quarter of the slab thickness.

5. Drainage

The collection and diversion of drainage away from the pavement surface is extremely important to the satisfactory performance of the pavement section. Proper drainage should be provided.

H. Design Review/Construction Observation

Design review and construction observations are recommended to verify the recommendations in this report are properly implemented and followed.

We recommend the following be done as a minimum:

1. Observe subgrade preparation and overexcavation and replacement of the collapsible soils (if required).
2. Conduct frequent compaction testing on fill placed. We recommend testing a testing frequency of approximately every 2 vertical feet.
3. Conduct construction materials testing on subgrade, base course, concrete, and asphalt as per Southern Utah University and/or Cedar City specifications.
4. Conduct special inspections in accordance with the plans and specifications.

The recommended observations and testing will be conducted by qualified individuals and according to standard test methods (ASTM, ICBO, ACI).

LIMITATIONS

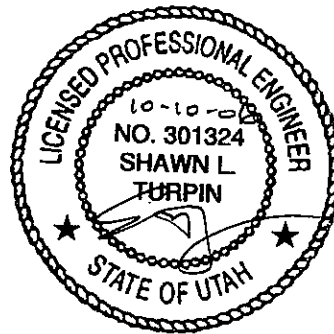
This report has been prepared in accordance with generally accepted soil and foundation engineering practices in the area for the use of the client for design purposes. The conclusions and recommendations included within the report are based on the information obtained from the boring drilled, the data obtained from laboratory testing, and our experience in the area. Variations in the subsurface conditions may not become evident until additional exploration or excavation is conducted.

If the subsurface soil or groundwater conditions are found to be different from what is described in this report, we should be notified to reevaluate the recommendations given.

Sincerely,

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

Shawn Turpin, P.E.



Reviewed by: Arnold DeCastro, P.E.

ST



DeLorme Street Atlas, 2004

SOUTHERN UTAH UNIVERSITY
HEAT PLANT UNDERGROUND STORAGE TANKS
CEDAR CITY, UTAH

SOUTHERN UTAH UNIVERSITY
HEAT PLANT UNDERGROUND STORAGE TANKS
CEDAR CITY, UTAH

- Approximate boring location
- ⊙ Benchmark; finished floor elevation, assumed 100 feet.



Not to Scale

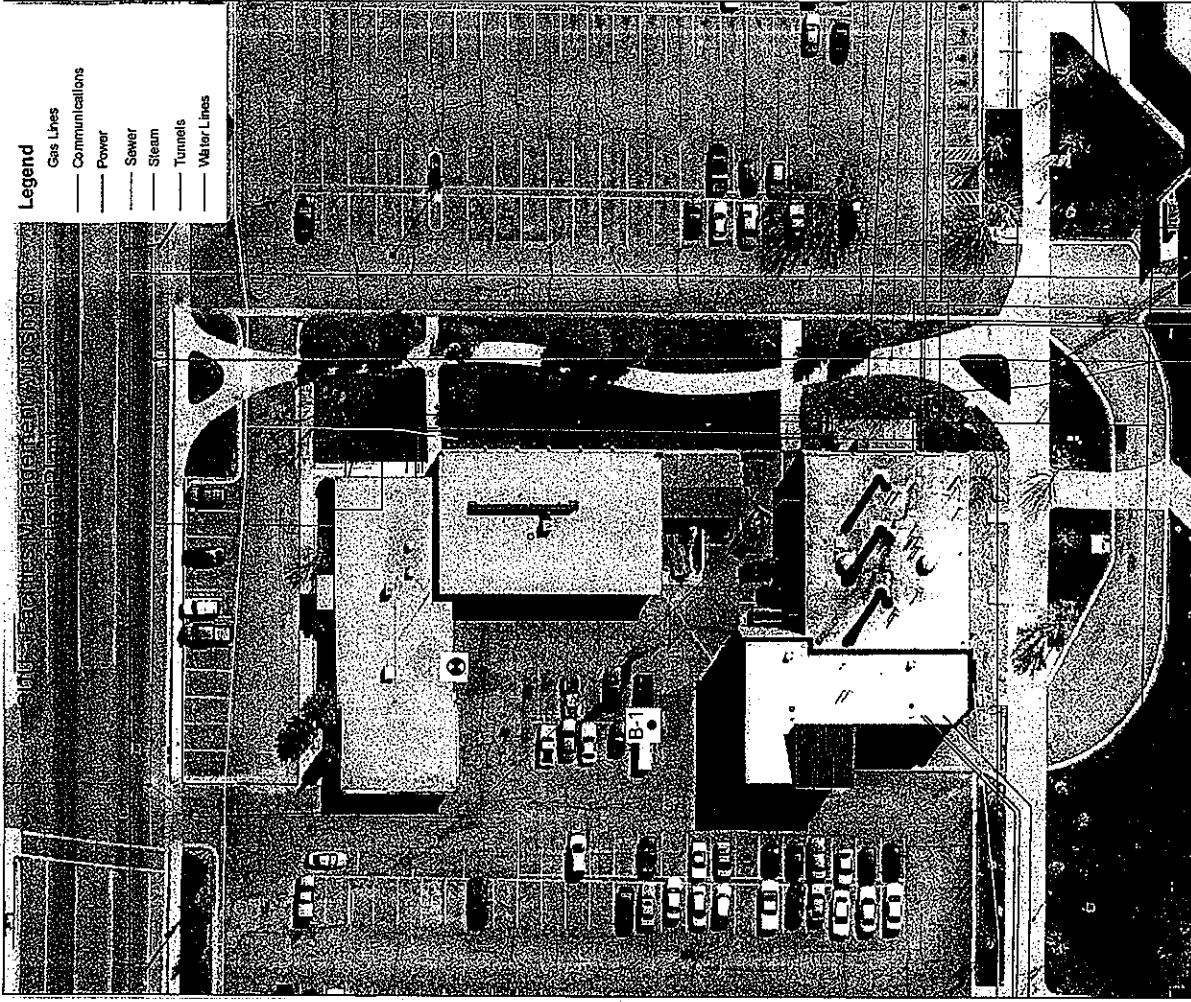


Figure 2

Site Plan



2061959

LEGEND:



Asphalt; good condition, black.



Base course; moderately compacted, dry to slightly moist, brown.



Lean clay (CL); medium stiff, moist, medium plastic, brown.



Silty clayey sand with gravel (SC-SM); medium dense to dense, slightly moist to moist, fine-grained, brown to red.



Silty sand with gravel (SM); medium dense, dry to slightly moist, fine-grained, brown.



10/12 California Drive sample taken. The symbol 10/12 indicates that 10 blows from a 140 pound hammer falling 30 inches were required to drive the sampler 12 inches.

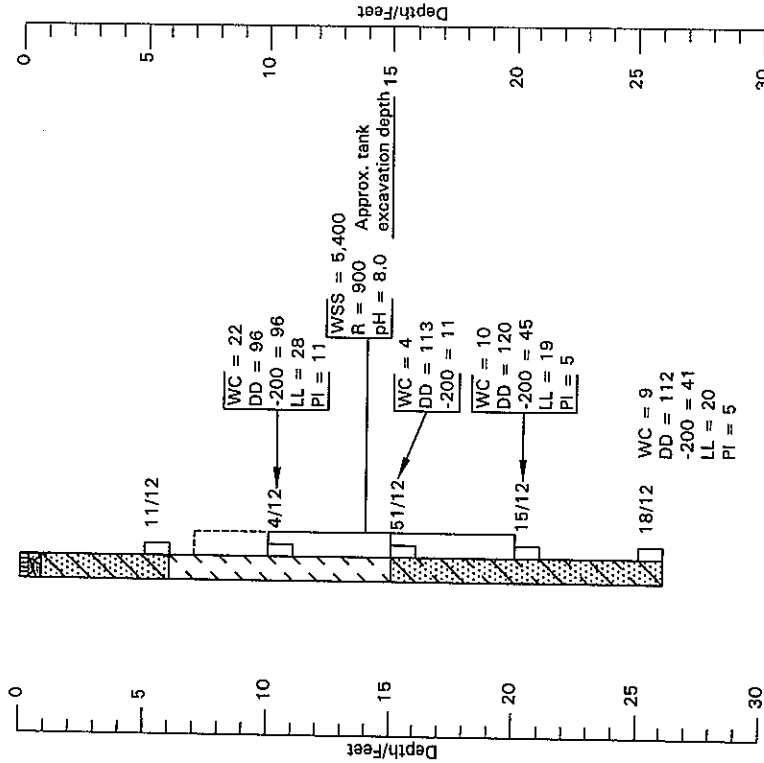


Indicates disturbed sample taken.

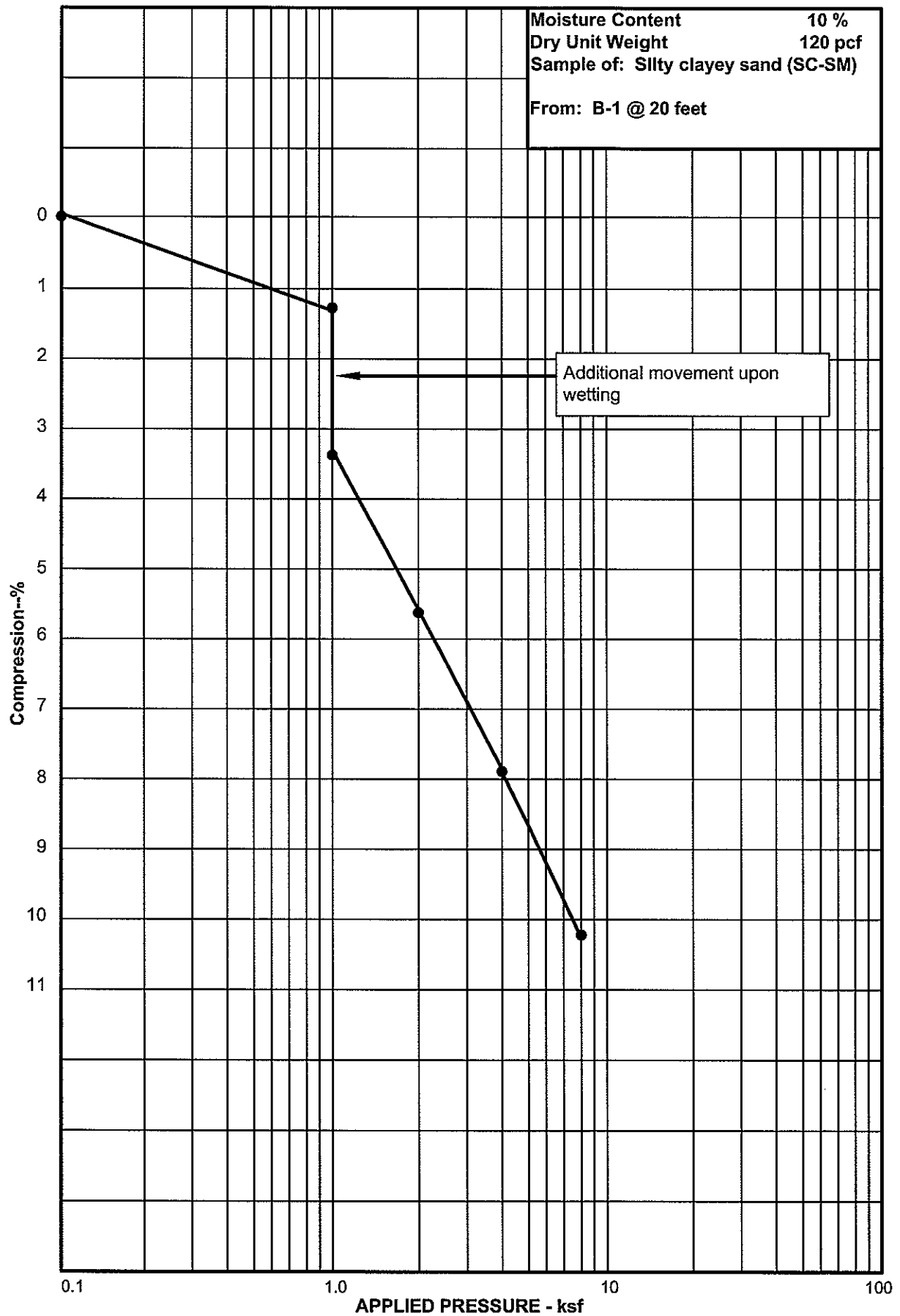
NOTES:

1. The boring was drilled on September 12, 2006 with 7-inch hollow-stem augers.
2. The location of the boring was measured by pacing from features shown on the site plan provided.
3. The elevation of the boring was determined with a hand level and refers to the benchmark shown on Figure 2.
4. The boring location and elevation should be considered accurate only to the degree implied by the method used.
5. The lines between the materials shown on the boring log represent the approximate boundaries between material types and the transitions may be gradual.
6. No free water was encountered in the boring at the time of drilling.
7. WC = Water Content (%);
DD = Dry Density (pcf);
-200 = Percent Passing No. 200 Sieve;
LL = Liquid Limit (%);
PI = Plasticity Index (%);
WSS = Water Soluble Sulfates (ppm);
R = Resistivity (ohm-cm).

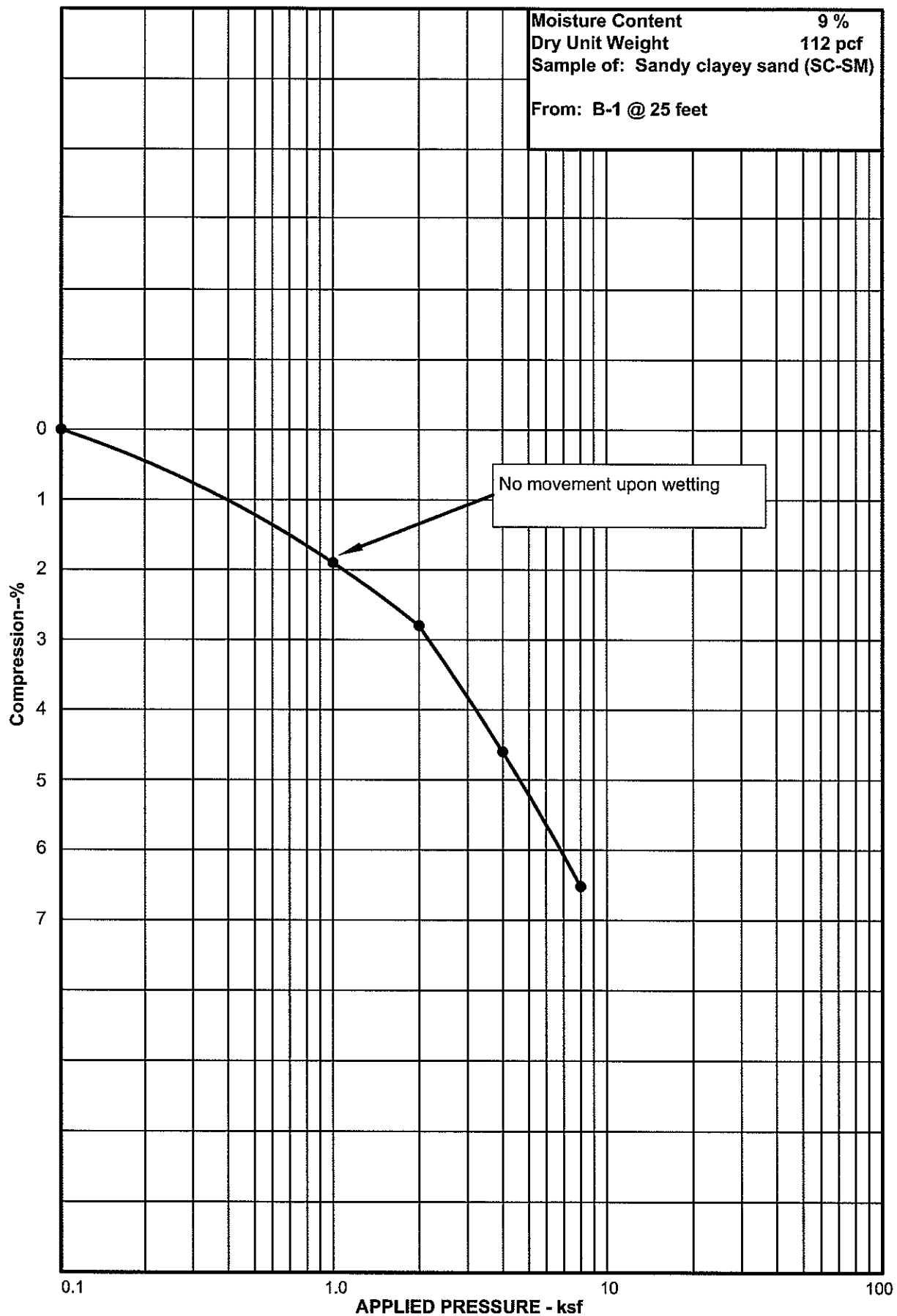
B-1
Elev. 99'



Applied Geotechnical Engineering Consultants, Inc.



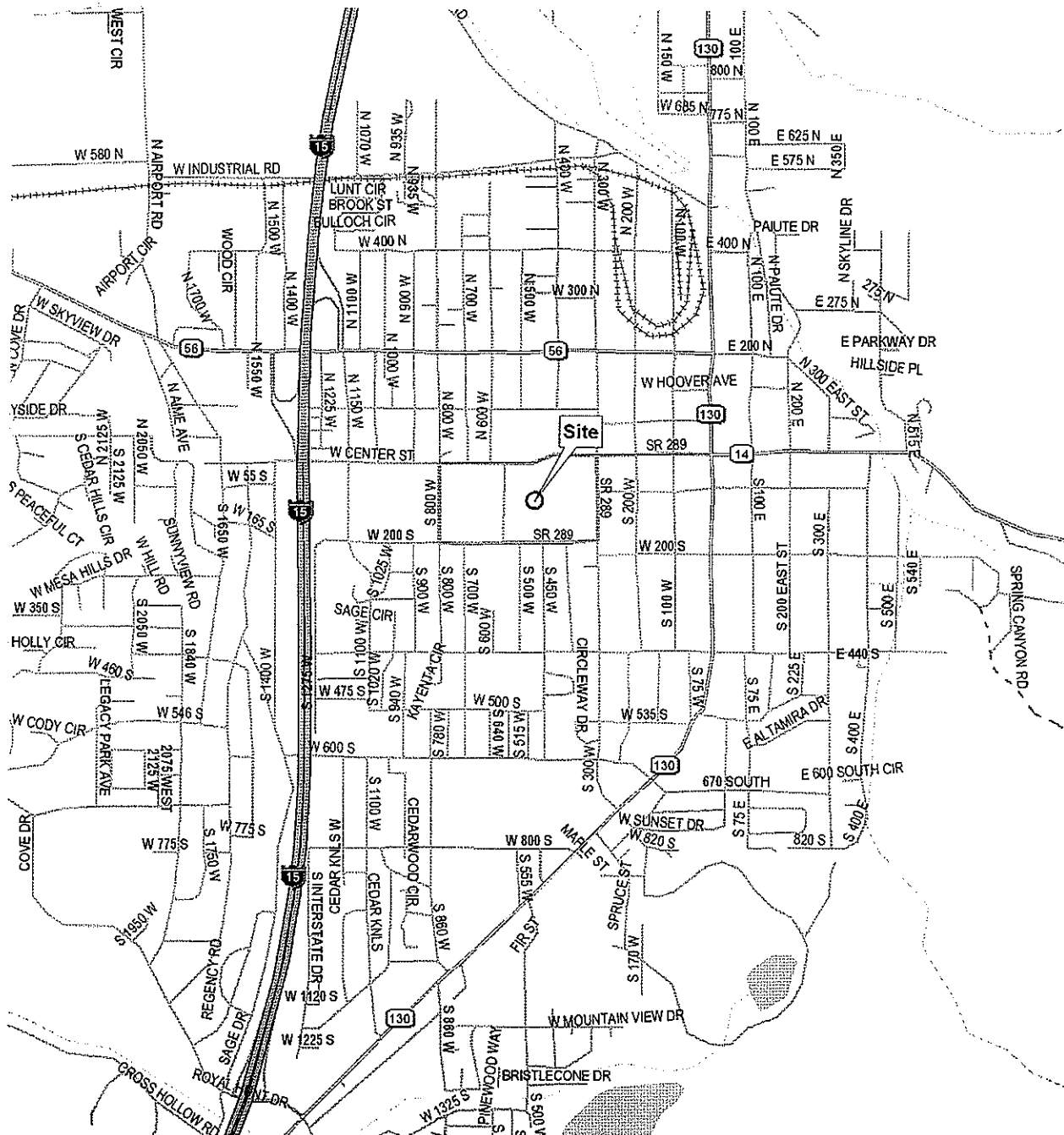
Applied Geotechnical Engineering Consultants, Inc.



Applied Geotechnical Engineering Consultants, Inc.

Table 1 - Summary of Laboratory Test Results

| SOUTHERN UTAH UNIVERSITY HEAT PLANT TANKS | | | | | | | | | | | Project No. 2061959 | |
|---|------------|------------------------------|---------------------------|------------|----------|---------------|------------------|-------------------|----------------------|-----|------------------------------|---|
| Sample Location | | Natural Moisture Content (%) | Natural Dry Density (pcf) | Gradation | | | Atterberg Limits | | Resistivity (ohm-cm) | pH | Water Soluble Sulfates (ppm) | Soil Type |
| Boring No. | Depth (ft) | | | Gravel (%) | Sand (%) | Silt/Clay (%) | Liquid Limit (%) | Plastic Index (%) | | | | |
| B-1 | 10 | 22 | 96 | | | 96 | 28 | 11 | | | | Lean clay (CL) |
| B-1 | 10-15 | | | | | | | | 900 | 8.0 | 5,400 | Lean clay (CL) |
| B-1 | 15 | 4 | 113 | | | 11 | | | | | | Poorly graded sand with silt and gravel (SP-SM) |
| B-1 | 20 | 10 | 120 | | | 45 | 19 | 5 | | | | Silty clayey sand (SC-SM) |
| B-1 | 25 | 9 | 112 | | | 41 | 20 | 5 | | | | Silty clayey sand (SC-SM) |



DeLorme Street Atlas, 2004

SOUTHERN UTAH UNIVERSITY
HEAT PLANT UNDERGROUND STORAGE TANKS
CEDAR CITY, UTAH



Scale 1:25,000

2061959



Vicinity Map

Figure 1

DIVISION 1
GENERAL REQUIREMENTS

- 01100 SUMMARY
- 01200 DEFINITIONS AND STANDARDS
- 01300 PROCEDURES AND CONTROLS
- 01310 PROJECT MANAGEMENT AND COORDINATION
- 01330 SUBMITTAL PROCEDURES
- 01732 SELECTIVE DEMOLITION
- 01770 CLOSEOUT PROCEDURES
- 01781 PROJECT RECORD DOCUMENTS

SECTION 01100 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Type of Contract.
 - 3. Owner's occupancy requirements.
 - 4. Work restrictions.
 - 5. Specification formats.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Southern Utah University Heat Plant Fuel Tank and Generator Replacement.
 - 1. Project Location: Southern Utah University Central Boiler Plant, Cedar City, Utah.
- B. Owner: Southern Utah University.
 - 1. Owner's Representative: DFCM.
 - 2. DFCM Project Number: 06127730.
- C. Architect: WHW Engineering 1354 East 3300 South #200 Salt Lake City, Utah 84106.
- D. The Work consists of the following:
 - 1. The replacement of the emergency generator and all associated wiring, panels, connections, conduit, etc. required for change.
 - 2. Provide two (2) 15,000 gallon, FRP underground storage tanks (UST).
 - 3. Provide two (2) fuel oil positive displacement transfer pumps.
 - 4. New parts, electrical and part changes to existing oil gun and piping for Coen burner.
 - 5. All new fuel oil supply and return piping (direct buried and internal exposed), vent piping, fill piping, manways, manholes, monitoring and gauging.

1.4 TYPE OF CONTRACT

- A. Project will be constructed under a single prime contract.

1.5 USE OF PREMISES

- A. General: Contractor shall have use of premises for construction operations as indicated in project documents.
- B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Owner Occupancy: Allow for Owner occupancy around Project site and use by the public.
 - 2. Driveways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Maintain existing central boiler plant, auto shop and physical facilities buildings in a protective condition throughout construction period. Repair damage caused by construction operations. Protect buildings and their occupants during construction period.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: Owner will occupy site and existing buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
 - 3. Restrict actual construction site, excavation and piping installation from students, facility and SUU personnel with construction fences and warning signs.

1.7 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 8:00 a.m. to 5:00 p.m., Monday through Friday, except otherwise indicated, or agreed upon between owner and contractor.

- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.

1.8 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.
 - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 - 2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01100

SECTION 01200 - DEFINITIONS AND STANDARDS

PART 1-GENERAL

1.1 DEFINITIONS

- A. General: Except as specifically defined otherwise, the following definitions shall supplement definitions of the Contract, General Conditions, Supplementary Conditions and other general contract documents, and apply generally to the work.
- B. General Requirements: The provisions of Division-1 sections, General Requirements, apply to the entire work of the Contract.
- C. Indicated: Shown on drawing by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "schedules", and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.
- D. Directed, Requested, Approved, Accepted, etc.: These terms imply "by the Engineer", unless otherwise indicated.
- E. Approved by Engineer: In no case releases Contractor from responsibility to fulfill requirements of contract documents.
- F. Project Site: Space available to Contractor at location of project, either exclusively or to be shared with separate contractors, for performance of work.
- G. Furnish: Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar subsequent requirements.
- H. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar requirements.
 - 1. Provide: Furnish and install, complete and ready for intended use.
- I. Installer: Entity (firm or person) engaged to install work, by Contractor, subcontractor or sub-sub contractor. Installers are required to be skilled in work they are engaged to install.
- J. Specification Text Format: Underscoring facilitates scan reading, no other meaning. Imperative language is directed at Contractor, unless otherwise noted.
- K. Overlapping/Conflicting Requirements: Most stringent (generally) requirement written directly into the contract documents is intended and will be enforced, unless specifically detailed language written into the contract documents clearly indicates that a less stringent requirement is acceptable. Refer uncertainties to the Architect/Engineer for a decision before proceeding.

1. Where optional requirements are specified in a parallel manner, option is intended to be Contractor's unless otherwise indicated.
- L. Minimum Requirements: Indicated requirements are for a specific minimum acceptable level of quality/quantity, as recognized in the industry. Actual work must comply (within specified tolerances), or may exceed minimums within reasonable limits. Refer uncertainties to Architect/Engineer before proceeding.
- M. Abbreviations, Plural Words: Abbreviations, where not defined in contract documents, will be interpreted to mean the normal construction industry terminology, determined by recognized grammatical rules, by the Engineer. Plural words will be interpreted as singular and singular words will be interpreted as plural where applicable for context of contract of documents.
- N. Testing laboratory: An independent entity engaged for the project to provide inspections, tests, interpretations, reports and similar services.

1.2 STANDARDS AND REGULATIONS

- A. Industry Standards: Applicable standards of construction industry have same force and effect on performance of the work as if copied directly into contract documents or bound and published therewith. Standards referenced in contract documents or in governing regulations have precedence over non-referenced standards, insofar as different standards may contain overlapping or conflicting requirements. Comply with standards in effect as of date of contract documents, unless otherwise indicated.
 1. Abbreviations: Where abbreviations or acronyms are used in contract documents, they mean the well recognized name of entity in building construction industry; refer uncertainties to Architect/Engineer before proceeding, or consult "Encyclopedia of Associations" by Gale Research Co.

PART 2-PRODUCTS

(Not Used)

PART 3-EXECUTION

(Not Used)

END OF SECTION 01200

SECTION 01300 - PROCEDURES AND CONTROLS

PART 1 - GENERAL

1.1 ADMINISTRATION AND SUPERVISION

- A. Coordination: Coordinate various elements of the work and entities engaged to perform work; and coordinate the work with existing facilities/conditions, and with work by separate contractors (if any) and by Owner.

1.2 SURVEY/RECORDING

- A. General: Calculate dimensions and measure for layout of work; do not scale the drawings. Record deviations (if any) from drawing information on existing conditions, and review with Engineer at time of discovery.

1.3 INSPECTION AND TESTING

- A. General: Provide required inspection and testing services specified to be by independent agencies, where not indicated specifically as Owner's responsibility (this provision supplements General Conditions). Neither inspection and test results nor failure thereof to disclose deficiencies relieves Contractor of responsibility to comply with requirements of contract documents. Provide services to inspection and testing agencies (Owner's and Contractor's), including taking and delivery of samples, patch work and similar assistance. Require engaged agencies to perform indicated testing and submit records promptly; and to report significant observations having an important bearing on the work, to the Architect/Engineer by the most expeditious means possible.

1.4 INSTALLATION, GENERAL

- A. Comply with manufacturer's instructions and recommendations to extent printed information is more detailed or stringent than requirements contained directly in contract documents.
- B. Timing: Install work during time and under conditions which will ensure best possible results, coordinated with required inspection and testing. Timing is of the up most importance.
- C. Anchor work securely in place, properly located by measured line and level, organized for best possible uniformity, visual effect, operations efficiency, durability, and similar benefit to Owner's use. Isolate non-compatible materials from contact, sufficiently to prevent deterioration.

1.5 CLEANING AND PROTECTION

- A. General: Clean each element of work at time of installation. Provide sufficient maintenance and protection during construction to ensure freedom from damage and deterioration at time of substantial completion.

PART 2 - PRODUCTS

Southern Utah University
Heat Plant Fuel Tanks & Generator Replacement
DFCM #06127730
(Not Used)

December 2006

PART 3 - EXECUTION
(Not Used)

END OF SECTION 01300

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General project coordination procedures.
 - 2. Conservation.
 - 3. Coordination Drawings.
 - 4. Administrative and supervisory personnel.
 - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
- B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.

5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.4 PROJECT MEETINGS

- A. General: Owner, DFCM and Engineer shall schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Shall include Owner's Representative, DFCM Representative, Engineer, Contractor's Superintendent, and Subcontractors.
- B. Preconstruction Conference: DFCM shall schedule a preconstruction conference before starting construction, at a time convenient to all required to attend. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing.
 - d. Designation of responsible personnel.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for processing Applications for Payment.
 - g. Submittal procedures.
 - h. Preparation of Record Documents.
 - i. Use of the premises.
 - j. Responsibility for temporary facilities and controls.
 - k. Parking availability.
 - l. Office, work, and storage areas.
 - m. Equipment deliveries and priorities.
 - n. First aid.
 - o. Security.
 - p. Progress cleaning.
 - q. Working hours.
- C. Progress Meetings: Attend progress meetings as required by DFCM and Engineer. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
 - 14) Documentation of information for payment requests.
3. Reporting: Engineer shall distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- D. Coordination Meetings: Conduct Project coordination meetings as may be required. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
 - 1. Divisions 2 through 16 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Engineer's responsive action.

1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Processing Time: Allow seven (7) days for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 7 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Resubmittal Review: Allow 7 days for review of each resubmittal.
- C. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
- D. Deviations: Highlight or encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- E. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form.
- F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are approved.
- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. Mark each copy of each submittal to show which products and options are applicable.
 - 2. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Manufacturer's catalog cuts.
 - e. Wiring diagrams showing factory-installed wiring.
 - f. Printed performance curves.
 - g. Operational range diagrams.
 - h. Standard product operation and maintenance manuals.
 - i. Compliance with specified referenced standards.
 - j. Testing by recognized testing agency.
 - k. Application of testing agency labels and seals.
 - l. Notation of coordination requirements.
 - 3. Number of Copies: Submit five copies of Product Data, unless otherwise indicated. Engineer will return four copies. Mark up and retain one returned copy as a Project Record Document.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

- A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- C. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01330

SECTION 01732 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of interior fuel oil piping and renovation of existing oil burner gun.
 - 2. Asphalt and excavation material.
- B. Related Sections include the following:
 - 1. Division 1 Section "Summary" for use of premises and Owner-occupancy requirements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.

1.5 PROJECT CONDITIONS

- A. Owner will occupy building and site where selective demolition will take place. Conduct selective demolition so Owner's operations will not be disrupted.
 - 1. Comply with requirements specified in Division 1 Section "Summary."
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Owner will remove hazardous materials under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been located and protected.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.
- D. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary."

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from excavation site.
 - 2. Provide temporary weather protection, if needed, to prevent water leakage and damage to excavation.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Dispose of demolished items and materials promptly.
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 01732

SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. Related Sections include the following:
 - 1. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 2. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.
 - 3. Division 15 Section 15010 "General Requirements."

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, maintenance service agreements, final certifications, and similar documents.
 - 4. Prepare and submit Project Record Documents, operation and maintenance manuals, damage surveys, and similar final record information.
 - 5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 6. Complete startup testing of pumps and burner using the No. 2 fuel oil.
 - 7. Submit UST testing reports and tank diameter measurements per notes on sheet ME502.
 - 8. Remove all construction items, tools, barriers, fencing from Project site.

9. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 10. Complete final cleaning requirements, including touchup painting.
 11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to General Conditions.
 2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual. Bind in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion. This is for areas only disturbed by this contractor.
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, of rubbish, asphalt and concrete waste, waste material, litter, and other foreign substances.
 - b. Sweep asphalt paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Clean exposed exterior vent piping and cap and manhole and manway covers to a dirt-free condition, free of stains, films, and similar foreign substances.
 - e. Remove labels that are not permanent.
 - f. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - g. Wipe surfaces of new mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - h. Leave Project clean.

- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

SECTION 01781 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
- B. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for general closeout procedures.
 - 2. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up Record Prints.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.

- c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. During progress meetings, Engineer will check red lined drawings.
- 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Locations and depths of underground piping.
 - d. Revisions to routing of piping and conduits.
 - e. Revisions to electrical circuitry.
 - f. Actual locations of tanks and pumps.
 - g. Tanks and Pumps.
 - h. Changes made by Change Order or Change Directive.
 - i. Changes made following Engineer's written orders.
 - j. Details not on the original Contract Drawings.
 - k. Field records for variable and concealed conditions.
 - l. Record information on the Work that is shown only schematically.
- 3. Mark the Contract Drawings completely and accurately.
- 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

END OF SECTION 01781

DIVISION 2
SITE CONSTRUCTION

02230 SITE CLEARING
02260 EXCAVATION SUPPORT AND PROTECTION
02300 EARTHWORK
02741 HOT MIX ASPHALT PAVING
02900 LANDSCAPING

SECTION 02230 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing surrounding asphalt, buildings, etc.
 - 2. Removing existing asphalt where required by drawings.
 - 3. Clearing any obstructions from construction area.
 - 4. SUU to remove all vehicles from construction area.
 - 5. Temporary erosion and sedimentation control measures.
- B. Related Sections include the following:
 - 1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities, temporary security and protection facilities.
 - 2. Division 1 Section "Execution Requirements" for verifying utility locations and for recording field measurements.
 - 3. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

1.3 MATERIAL OWNERSHIP

- A. Cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
 - 1. Obtain approved borrow soil materials off-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Protect existing buildings, footings, etc. from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction.

3.3 UTILITIES

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. A known underground sewer line is located in the area of construction - See drawings. Contractor shall locate and protect during excavation for storage tanks.
 - 2. Notify Engineer not less than 72 hours in advance of proposed utility interruptions.
 - 3. Do not proceed with utility interruptions without Engineer's written permission.

3.4 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove asphalt paving and excavated material from site and deposit in an approved land fill.
 - 1. Neatly saw-cut existing asphalt pavement to dimensions shown on the drawings. Saw-cut faces vertically.

3.5 DISPOSAL

- A. Disposal: Remove surplus soil material, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
 - 1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 02230

SECTION 02260 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes temporary support and protection during excavation and backfill.
- B. This Section will only be used if unforeseen conditions with existing soils are found.
- C. Related Sections:
 - 1. Division 1 Section "Construction Progress Documentation" for recording preexisting conditions and excavation support and protection system progress.
 - 2. Division 1 Section "Temporary Facilities and Controls" for temporary utilities and support facilities, if required
 - 3. Division 2 Section "Earthwork".
 - 4. Division 2 Section "Site Clearing".

1.3 PERFORMANCE REQUIREMENTS

- A. Furnish and maintain excavation support and protection system capable of supporting excavation sidewalls if required by unknown conditions.
 - 1. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 2. Install excavation support and protection, if required, without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 3. Monitor settlements and movements.

1.4 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
 - a. Geotechnical report.
 - b. Existing utilities and subsurface conditions.
 - c. Proposed excavation.
 - d. Proposed equipment.

- e. Monitoring of excavation support and protection system.
- f. Working area stability.
- g. Coordination with waterproofing.
- h. Removal of excavation support and protection system.
- i. Safety barriers.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving the existing buildings in this area occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Owner no fewer than 72 hours in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Owner's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
 - 1. The geotechnical report is included elsewhere in the Project Manual.
- C. Survey Work: Engage a qualified land surveyor or Contractor's own qualified surveyor to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, asphalt pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems, if required, to ensure minimum interference with adjacent occupied and used facilities.
 - 1. Do not close or obstruct access streets, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 BRACING

- A. Bracing: Locate bracing to clear permanent work. If necessary to move brace, install new bracing before removing original brace.
 - 1. Do not place bracing where it will be cast into or included in permanent excavation.
 - 2. Maintain bracing until permanent construction is completed, concrete pad installed and tanks installed.

3.3 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems, if used, when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing new storage tanks, concrete, piping, pavements, facilities, and piping.
 - 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.

2. Fill voids immediately with approved backfill compacted to density specified in Division 2 Section "Earthwork."
3. Repair or replace, as approved by Engineer, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place, if used.

END OF SECTION 02260

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for asphalt paving.
 - 2. Excavating and backfilling for underground storage tanks.
 - 3. Subbase and base course for asphalt paving.
 - 4. Subsurface drainage backfill for trenches.
 - 5. Excavating and backfilling trenches for buried mechanical and electrical utilities.
- B. Related Sections include the following:
 - 1. Division 2 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping, and removal of above- and below-grade improvements.
 - 2. Division 2 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
 - 3. Division 3 Section "Cast-in-Place Concrete".
 - 4. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades. See details on drawings.
- H. Structures: Buildings, footings, foundations, slabs, tanks, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 1557 for borrow soil material proposed for fill and backfill.

1.5 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Engineer not less than 72 days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Engineer's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials for engineered fill under concrete hold down slab. Do not use any soil material from excavation.
- B. Satisfactory Soils: For Engineered fill ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 1-1/2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Engineered Fill: 12" layer under concrete slab made from off-site naturally graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 100 percent passing a 1-1/2-inch sieve.
- E. Bedding Course: Naturally or artificially graded pea gravel; ASTM D 2940; except with 100 percent passing a 5/8-inch sieve.
- F. Filter Material: Pea gravel; ASTM D 448; with 100 percent passing a 5/8-inch sieve.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, walkways, asphalt pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations is specified in Division 2 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. Do not use any of the excavated materials for fill and backfill.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction as indicated and dimensioned on the drawings.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavation for Underground Tanks. Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR PAVEMENTS

- A. Excavate surfaces under pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line. See drawings for underground piping elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for joints and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 2. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course.
 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

- A. Notify Engineer and Geo-Tech when excavations have reached required subgrade.
- B. If Engineer and Geo-Tech determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade at bottom of excavation, see drawings, with heavy equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials i.e. engineered fill and pea gravel, without intermixing. Place stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of trees, buildings, etc.

3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction of tanks, concrete, piping, etc. below finish grade.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground piping, and tanks. See tank testing sheet ME502.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting, if required.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for joints and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated with compacted pea gravel.
- D. Place and compact backfill of, free of particles larger than 5/8 inch in any dimension, to a height of 12 inches over piping and conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with pipe testing.
- E. Controlled Low-Strength Material: Place pea gravel to a height of 12 inches over the piping and conduit.
- F. Place and compact final backfill of pea gravel to final subgrade elevation.
- G. Install warning tape directly above piping and conduit 6 inches below subgrade under asphalt pavements.

3.12 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers as indicated on the drawings to required elevations as follows:
 - 1. Under asphalt pavements, use pea gravel material.
 - 2. Under concrete tank hold down slab, use engineered fill.

- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry otherwise pea gravel material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill in layers indicated on the drawings.
- B. Place backfill evenly on all sides of concrete slab to required elevations, and uniformly along the full length of concrete slab.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 - 1. Under concrete slabs and asphalt pavements, compact each layer of backfill at 95 percent.
 - 2. For utility trenches, compact each layer of backfill material at 95 percent.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from site and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Pavements: Plus or minus 1/2 inch.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. At subgrade and at each compacted fill and backfill layer, at least 1 test for every layer. See drawings.
 - 2. Trench Backfill: At each compacted initial and final backfill layer, with no fewer than 3 tests.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

SECTION 02741 - HOT MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Hot-mix asphalt paving.
 - 2. Asphalt surface treatments.
 - 3. Pavement-marking paint.
- B. Related Sections:
 - 1. Division 2 Section "Site Clearing".
 - 2. Division 2 Section "Earthwork".
 - 3. Division 2 Section "Excavation Support".
 - 4. Use State of Utah standard specifications for references.

1.3 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

- A. Product Data: For type of product indicated. Include technical data and tested physical and performance properties.
- B. Qualification Data: For qualified manufacturer and Installer.
- C. Material Certificates: For paving material, from manufacturer.
- D. Material Test Reports: For paving material.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by Engineer, SUU and UDOT.

- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of UDOT and SUU for asphalt paving work.
- D. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 60 deg F.
 - 2. Tack Coat: Minimum surface temperature of 60 deg F.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations and are approved by SUU design standards, UDOT, and State of Utah Specifications.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand, gravel, cured blast-furnace slag, or combinations thereof.
 - 1. Limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a.
- B. Asphalt Cement: ASTM D 3381 for viscosity-graded material, ASTM D 946 for penetration-graded material.
- C. Prime Coat: ASTM D 2027, medium-curing cutback asphalt.
- D. Prime Coat: Asphalt emulsion prime coat complying with UDOT and University requirements.
- E. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt.
- F. Slurry Coat: Comply with weather limitations in ASTM D 3910.
- G. Fog Seal: ASTM D 977 or AASHTO M 140 emulsified asphalt.
- H. Water: Potable.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.
- C. Joint Sealant: ASTM D 6690 or AASHTO M 324, hot-applied, single-component, polymer-modified bituminous sealant.

- D. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248; colors complying with FS TT-P-1952.
 - 1. Color: Yellow, or as required by SUU.
- E. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.
 - 1. Color: Yellow, or as required by SUU.
- F. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
 - 1. Color: Yellow, or as required by SUU.
- G. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
 - 1. Color: Yellow, or as required by SUU.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Coordinate with SUU.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 8 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

- D. Verify that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of asphalt.

3.2 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses required.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 12 feet wide unless infill edge strips of a lesser width are required. Spreading shall conform to sections 303.09 and 303.11 of State of Utah standard Specifications.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.4 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending" and "Resumption of Paving Operations."
 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.5 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 and ASTM D 1559, but not less than 94 percent nor greater than 100 percent.
 2. Average Density: No test below 92 percent of reference maximum theoretical density according to ASTM D 2041.

- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.

3.7 SURFACE TREATMENTS

- A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.
- B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.
 - 1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.8 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer and SUU.
- B. Allow new paving to age for 10 days before starting pavement marking.

- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, using existing with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549. Overall thickness shall be 9 inches. See drawings.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow milled materials to accumulate on-site.

END OF SECTION 02741

SECTION 02900 - LANDSCAPING

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The contractor shall perform all the landscaping and all appurtenant work, complete, in accordance with the requirements of the Contract Documents.
- B. Scope of Work: Landscaping as referred to herein shall include the sidewalk area shown on sheet U-101, but not be limited to the following work: soil preparation, installation of headers, weed control, finish grading, furnishing and installing plant materials, tree staking and tying, cleanup, maintenance, and guarantee.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Federal Specifications:
 - 1. FS O-F-241 D Fertilizer, Mixed, Commercial
- B. Commercial Standards
 - 1. ANSI/ASTM D 422 Method for Particle-Size Analysis of Soils
 - 2. American Association of Rules and Grading Provisions Nurserymen, Inc.

1.3 CONTRACTOR SUBMITTALS

- A. Topsoil Report: Topsoil report as well as literature on fertilizers, mulch "Silva-fiber" and seed mixes, shall be submitted.

1.4 CLEANUP

- A. Upon completion of the sod installation and the portion of the project site used for a work or storage area by the contractor shall be cleaned of all debris, superfluous materials, and equipment. All such materials and equipment shall be entirely removed from the project site.
- B. All walks and pavement shall be swept or washed clean upon completion of the work of this Section.

1.5 MAINTENANCE OF LANDSCAPE PLANTING PRIOR TO ACCEPTANCE OF PROJECT

- A. General: The contractor shall be responsible for protecting, watering, and maintaining all planting and irrigation systems until final acceptance of all work under the contract.
- B. At time of acceptance of the complete project, the sod lawn shall be totally established with no bare spots, mowed a minimum of 2 times, and the grass shall be at least 1-1/4 to 2 inches in height.

- C. Upon completion of lawn sodding, the entire area shall be soaked to saturation by a fine spray. The new planting shall be kept watered by the sprinkling system existing on the site during dry weather or whenever necessary for proper establishment of the lawn. Care shall be taken to avoid excessive washing or puddling on the surface and any such damage caused thereby shall be repaired by the CONTRACTOR at its own expense.
- D. Protection: The CONTRACTOR shall provide adequate protection to all newly planted areas including the installation of approved temporary fences to prevent trespassing and damage, as well as erosion control, until acceptance.
- E. The CONTRACTOR shall replace any materials or equipment it has damaged or which has been damaged by its employees or subcontractors.
- F. Partial utilization of the project shall not relieve the CONTRACTOR of any of the requirements contained in the Contract Documents.
- G. Mowing of Lawn Areas: First mowing of lawn areas shall begin as soon as the grass has reached a height of 3 inches and subsequent mowing shall be at least once a week, or as often as necessary to maintain all lawn areas at a uniform height of 1-1/2 to 2 inches.
- H. All lawns shall be fertilized every 3 weeks with 6 lb of 16-8-8 commercial fertilizer per 1000 sq ft for the first 7 weeks and fertilized thereafter once each 5 months prior to acceptance.
- I. Maintenance shall include, in addition to the foregoing, cleaning, edging, repairs to stakes, wire, and wrappings, the repair of erosion, and all other necessary work of maintenance. Sidewalks and other paved areas shall be kept clean while planting and maintenance are in progress.
- J. Any and all sprinkler lines broken or disrupted during this construction shall be replaced to proper working order prior to contract work and be acceptable to the Owner.

1.6 FINAL INSPECTION AND GUARANTEE

- A. Inspection of work of new lawn will be made at conclusion of maintenance.
- B. Written notice requesting inspection shall be submitted at least 10 days prior to the anticipated inspection date.
- C. Final acceptance of the work prior to guarantee period of the contract will be accepted upon written approval of Architect, on the satisfactory completion of all work, including maintenance, but exclusive of the replacement of plant material.
- D. All work done under this contract shall be left in good order to the satisfaction of the owner and the Contractor shall, without additional expense to the Owner, replace any sod which develops defects or dies during the one-year guarantee period.

1.7 GUARANTEE FOLLOWING ACCEPTANCE OF PROJECT

- A. General: The Contractor shall be responsible for a period of one year after date of acceptance of all work under the Contract. The Contractor shall provide a written guarantee to the Owner from the landscaping subcontractor, embodying the provisions of this Section of the Specifications.
- B. The Work covered by the guarantee portions of these specifications consists of providing any sod replacement and in performing all operations in connection with guarantees.
- C. The Contractor shall clean-up and remove unused or waste materials from the site and leave the area in a neat condition (satisfactory to the Owner) whenever it performs work during the guarantee Period.
- D. Final Inspection: The Owner and Contractor shall make a final inspection at the end of the one-year guarantee period. Any materials found defective at time of final inspection shall be replaced within a time agreed upon by both parties. If it is too late in the planting season for replanting, the replacements shall be made during the next planting season even though such planting may run beyond the maintenance and correction period.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials for soil conditioning, weed abatement, or planting shall be first-grade, commercial quality and shall have certificates indicating the source of material, analysis, quantity, or weight attached to each sack or container or provided with each delivery. Delivery certificates shall be given to the Architect/Engineer as each shipment of material is delivered.

2.2 TOPSOIL

- A. Existing on site topsoil may be stripped and stockpiled on site for landscape use.
- B. Imported topsoil shall be obtained from naturally drained areas and shall be fertile, friable loam suitable for plant growth. Topsoil shall be subject to inspection and approval at the source of supply and upon delivery.
- C. The topsoil shall be of uniform quality, free from subsoil stiff or lumpy clay, hard clods, hardpan, rocks, disintegrated debris, plants, roots, seeds, and any other materials that would be toxic or harmful to plant growth. Topsoil shall contain no noxious weeds or noxious weed seeds.
- D. Imported topsoil shall contain at least 6 percent organic matter as determined by loss of weight after ignition of dried (moisture-free) samples in accordance with current methods of the Association of Official Agricultural Chemists.
- E. Imported acidity range of the topsoil shall be (pH 5.5 to pH 7.5). The salinity level

shall be less than 3 milliohms/cm.

- F. Imported topsoil clay, as determined by the Bouyoucous hydrometer or by the Recantation method, shall not exceed 60 percent of the topsoil material.
- G. Mechanical analysis shall be performed and shall conform to ANSI/ASTM D 422. Quality Assurance.

2.3 FERTILIZER AND ADDITIVES

- A. Fertilizer shall be furnished in bags or other standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon.
- B. Chemical fertilizers shall be a mixed commercial fertilizer conforming to FS O-F-241 D, Type I, with percentages of nitrogen, phosphoric acid, and potash at 5-10-5 and 16-16-8. The combined N-P-K content shall be following percentages of total weight: 5 percent nitrogen 10 percent phosphoric acid and 5 percent potash. Fertilizers shall be uniform in composition, dry, and free flowing.
- C. Tablets shall be 21 grams each 20-10-5 "Agriform," "Lesslie", or equal.
- D. "Nutri mulch" shall be composted manure mulch from Moroni, Utah feed lots "Pay Dirt or approved equal.
- E. Material shall have PH value of 4 to 5.
- F. Material may be supplied in bales or if domestic furnished in bulk. If furnished in bulk, material and its source must be acceptable to Owner

2.4 SOD GRASS

- A. The sod shall be nursery grown Kentucky Bluegrass drought tolerant blend of sod as noted on the plans. It shall be uniformly cut approximately 3/4-inch or more thick and shall be well rooted, 2-year old growth of permanent and desirable grasses indigenous to this general location. The sod shall be practically free from weeds and undesirable grasses.

2.5 CONCRETE EDGING

- A. Concrete edging will be extruded plans per details. Concrete work will conform to on site concrete flat work for quality.

PART 3 - EXECUTION

3.1 GENERAL

- A. The landscape work shall not be performed at any time when it may be subject to damage by climatic conditions.
- B. The Contractor shall provide temporary fencing, barricades, covering, or other

protections to preserve existing landscaping items indicated to remain and to protect the adjacent properties and other structures when they may be damaged by the landscape work.

- C. Waste materials shall be removed and disposed of off the Owner's property, unless otherwise indicated.
- D. It shall be the responsibility of the Contractor to avail itself of any information regarding utilities which are in the area of work and to prevent damage to the same. The Contractor shall provide protection to the utilities as necessary.
- E. Burning of combustible materials on the site shall not be permitted.
- F. The Contractor shall provide protection to structures, sidewalks, pavements, and other facilities in areas of work which are subject to damage during landscape work. Open excavations shall be provide with barricades and warning lights which conform to the requirements of governing authorities and the State's OSHA safety requirements from dusk to dawn each day and when needed for safety.

3.2 SOIL PREPARATION

- A. Areas requiring grading by the landscaper including adjacent transition areas shall be uniformly level or sloping between finish elevations to within 0.10-ft above or below required finish elevations.
- B. The landscape work shall not proceed until after walks, paving, edging, and irrigation systems are in place. The contract operations shall be completed to a point where the landscape areas will not be disturbed. The sub grade shall be cleaned free of waste materials of all kinds.
- C. During grading waste materials in the planting areas such as weeds, rocks (1 inches and larger) building materials, rubble, wires, cans, glass, lumber, sticks, etc., shall be removed from the site. Weeds shall be dug out by the roots.
- D. Fertilizers, additives, seed, peat, etc. subject to moisture damage shall be kept in a weatherproof storage place in such a manner that they will be kept dry.
- E. After removal of waste materials the planting areas sub grade shall be scarified and pulverized to a depth of not less than 6 inches and all surface irregularities below the cover of topsoil removed.
- F. Finish sub grade and topsoil placement and grading shall consist of:
 - 1. Prepare sub grade by rough grading and removing all irregularities and debris, then till and scarify subsoil to a depth of 6 inches before placing topsoil.
 - 2. Place 6 inches of topsoil over all lawn beds. Sub grade soil shall be in a loosened and rough surface finish before topsoil is placed over sub grade. (Sub-grade surface shall not be smooth, but a rough surface shall exist for a transition zone of topsoil to subsoil.) if areas of sub grade

- become compacted before topsoil is placed, sub grade shall be tilled again before topsoil placement.
3. Placing all soil additives and fertilizers for the areas as noted on the plan.
 4. Till lawn and planting area sub soils and top soils that are compacted.
 5. After tilling, bring areas to uniform grades by floating and/or hand raking.
 6. Make minor adjustment of finish grades as required for drainage.
 7. Remove waste materials over 1" in size such as stones, roots, or other undesirable foreign materials and finish raking, dishing, dragging, and smoothing soil ready for planting.
 8. No grading or soil placement shall be undertaken when soils are wet or frozen.
 9. Provide dust control measures at all times by wetting down the soil surface as required to prevent blowing dust.
- G. Topsoil shall be uniformly distributed over all areas where required. Sub grade and topsoil shall be damp and free from frost.
- H. Surface drainage shall be provided as shown by molding the surfaces to facilitate the natural run-off of water. Low spots and pockets shall be filled with topsoil and graded to drain properly.
- I. Finish grade of all planting areas shall be 2 inches below finish grades of adjacent pavement of any kind for sod areas.

3.3 SODDING

- A. Grass sod shall be provided where shown or specified and shall be maintained.
- B. The soil shall be prepared and fertilized before sodding. The Contractor shall prepare only enough ground that can be planted within 24 hours thereafter.
- C. Soil preparation shall consist of the following:
 1. Preparation of sub-grade grading shall be per "Part 3 - Execution" in Paragraphs entitled "General" and "Soil Preparation," herein.
 2. Fertilizer prepared lawn ground with 16-8-8 at 6 lbs per 1000 sq. ft.
- D. Sod shall be cut and laid on site the same day.
- E. The sod shall be placed over leveled, compacted, and prepared finish graded soil. The topsoil and sub-base shall be moist enough to resist shifting.
- F. Sod may be placed at any time when the ground is not frozen. The surface on which the sod is to be laid should be firm and free from footprints or other

depressions. A string or line of boards may be used as a guide for setting the first line of sod across the area. Sods of the next course are matched against the edge of this first line in such a way the joints between the individual sod pieces in the 2 lines do not coincide. Successive courses are matched against the last line laid, in the same manner.

- G. Sod shall always be laid across slopes.
- H. After sodding has been completed, the sodded area shall be cleaned up and thoroughly moistened by sprinklers.

END OF SECTION 02900

DIVISION 3
CONCRETE

03300 CAST IN PLACE CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Tanks hold down concrete pad.
 - 3. Concrete for pump base.
 - 4. Concrete around manways, manholes, etc.
 - 5. Slabs-on-grade.
 - 6. Re-inforcement.
 - 7. Form work.
 - 8. Embedded items, including anchor rods and bolts.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: Provide 5 copies to engineer for review and approval for each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, and supports for concrete reinforcement.

- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates
- F. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Curing compounds.
 - 6. Bonding agents.
 - 7. Adhesives.
 - 8. Repair materials.
- G. Concrete curing method.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Codes and Standards: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete,"
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. ACI 304.
 - 4. ACI 305.
 - 5. ACI 306.
 - 6. ACI 315.
 - 7. ACI 347.
 - 8. ASTM.
 - 9. 2003 IBC.

- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Galvanized Reinforcing Bars: Deformed bars, ASTM A 767/A 767M, Class I zinc coated after fabrication and bending.
- D. Epoxy-Coated Reinforcing Bars: Deformed bars, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
- E. Plain-Steel Wire: ASTM A 82, as drawn.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

- B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, ASTM A 775/A 775M epoxy coated.
- C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - 2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type II or III.
 - a. Fly Ash: ASTM C 618.
- B. Normal-Weight Aggregates: ASTM C 33.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight aggregate: ASTM C330, 3/8 inch nominal maximum aggregate size
- D. Water: ASTM C 94/C 94M and potable as long as it is clean and free from deleterious amounts of impurities likely to be injurious to concrete.

2.5 ADMIXTURES

- A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 1. Fly Ash: 25 percent.
 2. Combined Fly Ash and Pozzolan: 25 percent.
 3. Ground Granulated Blast-Furnace Slag: 50 percent.
 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 5. Silica Fume: 10 percent.
 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water reducing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.7 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 4500 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Slump Limit: 4 inches, plus or minus 1 inch.
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

- B. Foundation Walls: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Slump Limit: 4 inches, plus or minus 1 inch.
 - 3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
 - 4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
 - 5. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions.

2.8 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.10 EMBEDDED ITEMS

- A. Anchor Rods (Anchor Bolts) and Sleeves
 - 1. Anchor rods shall conform to ASTM F1554, Grade 36, and be furnished with two heavy hex nuts and one washer at the exposed end and one heavy hex nut at the embedded end. Sleeve, if indicated on the drawings, shall be of high impact plastic or Schedule 40 (Standard Weight) steel pipe with sleeve bottom closures of mild steel. Anchor rod threads shall be N.C. Class 1 fit Welding shall be in accordance with AWS recommended practice.
 - 2. Anchor rods, less than 1-1/4 inch diameter may be an adhesive anchor system by Hilti or Power Fasteners, or equal.

2.11 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
 - 1. Limit concrete surface irregularities, designated by ACI 347R.
- C. Construct forms tight enough to prevent loss of concrete mortar.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- G. Chamfer exterior corners and edges of permanently exposed concrete.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
- G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of slabs.
 - 2. Locate horizontal joints.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.6 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: For under tank pad and footings under wall, as-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
- B. Slab on grade: Sidewalk, generator pad, pump pad.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces exposed to view.
 2. Finish surfaces to the tolerances, according to ASTM E 1155, for a randomly trafficked floor surface.
 3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 3/16 inch
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces while concrete is still plastic, slightly scarify surface with a fine broom.

3.7 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Equipment Bases and Foundations: Provide tank and pump bases as shown on Drawings. Set anchor bolts for tank straps and pumps at correct elevations, complying with diagrams or templates from manufacturer furnishing tanks and pumps.

3.8 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces and supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including slabs and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
4. Curing and Sealing Compound: Apply uniformly to slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.9 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:

1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 11. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
 13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.
 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 15. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.
- D. Measure slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 03300

DIVISION 4
MASONRY

04810 UNIT MASONRY ASSEMBLIES

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the unit masonry assembly for the new wall and consisting of the following:
 - 1. Architectural face brick.
 - 2. Mortar and grout.
 - 3. Reinforcing steel.
 - 4. Masonry joint reinforcement.
 - 5. Miscellaneous masonry accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry by testing masonry prisms according to ASTM C 1314.
 - 1. For Brick Unit Masonry: Not less than f'm = 3000 psi.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color to match boiler building brick through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color to match boiler building brick for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Mortar Test: For mortar properties per ASTM C 270.

2. Grout Test: For compressive strength per ASTM C 1019.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover top of wall with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 2. Protection shall remain in place until final weatherproof covering has been installed. Once masonry work has commenced the Contractor shall reimburse the Owner the sum of \$500.00 per day that the masonry work is not protected.
- B. Do not apply any loads on the new wall for at least 12 hours.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 1. Protect base of wall from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in Section 2104.3 of the International Building Code.
 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
 1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind

velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL FACE BRICK

- A. General: Provide shapes indicated and as follows for brick required:
 - 1. Provide units without cores or frogs and with exposed surfaces finished for ends and caps and for similar applications that would otherwise expose unfinished brick surfaces.
- B. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 1. Provide special shapes for applications where stretcher units cannot accommodate special conditions.
 - 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- C. Architectural Face Brick: ASTM C 216, Grade SW, Type FBX, and as follows:
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 8000 psi.
 - 2. Initial Rate of Absorption: Less than 20 g/30 sq. in. per minute when tested per ASTM C 67.
 - 3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 4. Size: Manufactured to the following actual dimensions:
 - a. Modular: 3-1/2 to 3-5/8 inches wide by 2-1/4 inches high by 7-1/2 to 7-5/8 inches long.
 - 5. Application: Use where brick is exposed, unless otherwise indicated.
 - 6. Color and Texture: Match face brick color used for boiler building.
 - 7. Products: Subject to compliance with requirements, provide the following:
 - a. Interstate Brick.

2.2 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- D. Aggregate for Grout: ASTM C 404.

- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
- F. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of the units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- G. Water: Potable.

2.3 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60.

2.4 MASONRY JOINT REINFORCEMENT

- A. General: ASTM A 951 and as follows:
 - 1. Hot-dip galvanized, carbon-steel wire.
 - 2. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
 - 3. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.

2.5 ADJUSTABLE MASONRY-VENEER ANCHORS

- A. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint, complying with the following requirements:
 - 1. Anchor Section: Gasketed sheet metal plate with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.
 - a. Plate 1-1/4 inches wide by 6 inches long with strap 5/8 inch wide by 6 inches long; slot clearance formed between face of plate and back of strap shall not exceed diameter of wire tie by more than 1/32 inch.
 - b. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and to prevent moisture from penetrating sheathing at pronged legs and screw holes.
 - 2. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire. Size wire tie to extend at least halfway through veneer but with at least 5/8-inch cover on outside face.
 - 3. Fabricate sheet metal anchor sections and other sheet metal parts from minimum 0.0677-inch- thick, steel sheet, galvanized after fabrication.
 - 4. Fabricate wire connector sections from minimum 0.1875-inch- diameter, hot-dip galvanized steel wire.

5. Continuous Wire: Minimum 0.1875-inch- diameter, hot-dip galvanized steel wire.

2.6 MASONRY CLEANERS

- A. Job-mixed detergent solution: Solution of 1/2-cup dry measure Tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gallon of water.

2.7 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, as indicated.
- C. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Limit pigments to the following percentages of cement content by weight:
 1. For mineral-oxide pigments and portland cement-lime mortar, not more than 10 percent.
- D. Grout for Unit Masonry: Comply with ASTM C 476, as indicated.
- E. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's directions.

2.8 SOURCE QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:
 1. Payment for these services will be made by Owner.
 2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 2. Verify that substrates are within tolerances specified.
 3. Verify that reinforcing is properly placed.

4. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build wall to the actual width and height shown on the drawings.
- B. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 1. Mix units from several pallets or cubes as they are placed.
- D. Wetting of Masonry: Wet masonry before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

3.3 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.
- D. For conspicuous horizontal lines, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
- E. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

3.5 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.6 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to concrete wall framing with anchors to comply with the following requirements:
 - 1. Embed tie sections in masonry joints.
 - 2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 3. Space anchors not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area.

3.7 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joints in unit masonry if required. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

3.8 FIELD QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform field quality-control testing indicated below.
 - 1. Payment for these services will be made by Owner.
 - 2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Mortar properties will be tested per ASTM C 780 .
- C. Grout will be sampled and tested for compressive strength per ASTM C 1019.

3.9 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
 - 4. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.

3.10 MASONRY WASTE DISPOSAL

- A. Excess Masonry Waste: Remove excess masonry waste and legally dispose of off Owner's property.

END OF SECTION 04810

DIVISION 9
FINISHES

09900 PAINTING

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Scope:
 - 1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section
 - 2. All exposed steel i.e. new piping supports, structural supports interior and exterior.

1.2 DESCRIPTION OF WORK

- A. Work includes field painting of exposed hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.
- B. "Paint" as used herein, means all coating systems materials, primers, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.
- C. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated. Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, engineer will select these from standard colors or finishes available.
- D. Following categories of work are not included as part of field-applied finish work.
 - 1. Pre-finished Items: Unless otherwise indicated, do not include painting when factory-finishing is specified.
 - 2. Finished Metal Surfaces: Unless other wise indicated, metal surfaces of anodized aluminum, chromium plate, bronze and similar finished materials will not require finish painting.
- E. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

1.3 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Manufacturer's stock number and date of manufacture.
 - 3. Manufacturer's name.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
- B. Store materials not in use in tightly covered containers in a well- ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.5 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 deg F above the dew point, or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include but are not limited to the following:
 - a. Benjamin Moore and Co. (Moore) or approved equal by.
 - b. Devoe and Raynolds Co. (Devoe).
 - c. The Glidden Company (Glidden).
 - d. PPG Industries, Pittsburgh Paints (Pittsburgh).
 - e. Pratt and Lambert (P & L).

- f. The Sherwin-Williams Company (S-W).
- g. Kwal-Howells Company

2.2 MATERIALS

- A. Material Quality: Provide best quality grade of various tubes of coatings as regularly manufactured by acceptable paint materials manufacturer's. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.
- B. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.
 - 1. Do not use red-lead base paints.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Applicator must examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.
 - 1. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
 - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.2 SURFACE PREPARATION

- A. General Procedures: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
 - 1. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Engineer in writing of any anticipated problems in using the specified coating systems with substrates primed by others.
 - 2. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
 - 3. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
 - 4. Ferrous Metals: Clean nongalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other

foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.

- a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

3.3 MATERIALS PREPARATION

- A. Mix and prepare paint materials in accordance with manufacturer's directions.
 1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.4 APPLICATION

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 1. Provide finish coats that are compatible with primers used.
 2. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
 3. Sand lightly between each succeeding enamel or varnish coat.
 4. Omit primer on metal surfaces that have been shop-primed and touch up painted.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

- D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to new items exposed in boiler rooms.
- F. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others.
 - 1. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.
- G. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.
- H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.5 CLEAN-UP AND PROTECTION

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
- B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Engineer.
 - 1. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
 - 2. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 EXTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates indicated.

- B. Ferrous Metal: Primer is not required on shop-primed items.
 - 1. Full-Gloss Alkyd Enamel: 2 finish coats over primer.
 - 2. Primer: Non-red Lead Pigmented Primer.
 - a. Primer is not required on items delivered shop primed.
 - 3. First and Second Finish Coats: High-gloss Alkyd Enamel (FS TT-E-489).
 - a. Moore: Impervo High Gloss Enamel Exterior/Interior.
 - b. Devoe: 70XX Mirrolac Alkyd Gloss Enamel or owner approved equal by.
 - c. Glidden: Y-4500-Line Glin-Guard Industrial Enamel.
 - d. Pittsburgh: 6-252 Speedhide Quick-Dry Alkyd Enamel.
 - e. P & L: Effecto Enamel.
 - f. S-W: S-W Metalistic II Enamel
- C. Zinc-Coated Metal:
 - 1. High-Gloss Alkyd Enamel: 2 finish coats over primer. Primer: Zink Dust-Zinc Oxide Primer (FS-T-P-641)
 - a. Moore: Moore's iron-clad galvanized metal primer or owner approved equal by.
 - b. Devoe: 14100 Zinc Dust Primer and Finish.
 - c. Glidden: Y-5229 Glid-Guard All-Purpose Metal Primer.
 - d. Pittsburgh: 6-215 Speedhide Galvanized Steel Primer.
 - e. S-W: S-W Galvanized Iron Primer.
 - 2. First and Second Coats: High-Gloss Alkyd Enamel (FS TT-E-489).
 - a. Moore impervo high glass enamel exterior/interior or owner approved equal by
 - b. Devoe: 70XX Mirrolac Interior/Exterior Alkyd Gloss Enamel
 - c. Glidden: Y-4500-Line - Glid Guard Alkyd Industrial Enamel.
 - d. Pittsburgh: 6-252 Speedhide Quick-Dry Alkyd Gloss Enamel.
 - e. S-W: S-W Metalistic II Enamel.

3.8 INTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates, as indicated.
- B. Ferrous Metal:
 - 1. Semigloss Enamel Finish: 2 coats over primer with total dry film thickness not less than 2.5 mils.
 - a. Prime Coat: Non-Red Lead Base Primer. Prime Coat is not required on items delivered shop primed.
 - b. First Coat: Interior Enamel Undercoat (FS TT-E-543).

- 1) Moore: Moore's Alkyd Enamel Underbody or owner approved equal by
 - 2) Devoe: 8801 Velour Alkyd Enamel Undercoat.
 - 3) Glidden: Y-4600 Series Spred Lustre Semi-Gloss Enamel.
 - 4) Pittsburgh: 6-6 Speedhide Quick-Drying Enamel Undercoater.
 - 5) P&L: Interior Trim Primer.
 - 6) S-W: S-W Pro-Mar Alkyd Semi-Gloss Enamel.
- c. Second Coat: Interior Semigloss Odorless Alkyd Enamel (FS TT-E-509).
- 1) Moore: Moore's Satin Impervo Enamel or owner approved equal by
 - 2) Devoe: 26XX Velour Alkyd Semi-Gloss Enamel
 - 3) Glidden: Y-4600 Line Spred Lustre Semi-Gloss Enamel
 - 4) Pittsburgh: 27-109 Wall-Hide Semi-Gloss Enamel.
 - 5) P&L: Pro-Hide Plus Alkyd Semi-Gloss Enamel.
 - 6) S-W: S-W Pro-Mar Alkyd Semi Gloss Enamel

C. Zinc-Coated Metal:

1. Semigloss Finish: 2 coats over primer, with total dry film thickness not less than 2.5 mils.
 - a. Prime Coat: Galvanized Metal Primer (FS TT-P- 641).
 - 1) Moore: Moore's Iron-Clad Galvanized Metal Primer
 - 2) Devoe: 14100 Zinc Dust Primer
 - 3) Glidden: Y-5229-Glid Guard All Purpose Metal Primer
 - 4) Pittsburgh: 6-215/6-216 Speedhide Galvanized Steel Paint Zinc Dust.
 - 5) S-W: S-W Galvanized Iron Primer.
 - b. Second Coat: Interior Enamel Undercoat (FS TT-E-543).
 - 1) Moore: Moore's Alkyd Enamel Underbody or owner approved equal by
 - 2) Devoe: 8801 Velour Alkyd Enamel Undercoat.
 - 3) Glidden: Y-4600 Series Spred Lustre Semi-Gloss Enamel.
 - 4) Pittsburgh: 6-6 Speedhide Quick-Drying Enamel Undercoater.
 - 5) S-W: S-W Pro-Mar Alkyd Semi-Gloss Enamel.
 - c. Third Coat or Fourth Coat: Odorless Interior Alkyd Semi-Gloss Enamel (FS-TT-P-509)
 - 1) Moore: Moore's Satin Impervo Enamel or owner approved equal by.
 - 2) Devoe: 26XX Velour Alkyd Semi-Gloss Enamel
 - 3) Glidden: Y-4600 Line Spred Lustre Semi-Gloss Enamel

- 4) Pittsburgh: 27-109 Wall-Hide Semi-Gloss Enamel.
- 5) S-W: S-W Pro-Mar Alkyd Semi Gloss Enamel

END OF SECTION 09900

DIVISION 15
MECHANICAL

- 15010 GENERAL REQUIREMENTS
- 15077 IDENTIFICATION FOR FUEL OIL PIPING AND EQUIPMENT
- 15126 METERS AND GAUGES FOR FUEL OIL PIPING
- 15192 FACILITY FUEL-OIL PIPING
- 15512 OIL BURNER MODIFICATIONS

SECTION 15010 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

- A. Drawings and General provisions of the contract, including general and supplementary conditions and other Division 01 specification sections, apply to this section.

1.2 SCOPE

- A. Includes -
 - 1. Furnish all labor, materials, and equipment necessary for the completion of the scope of work.
 - 2. Furnish and install all motors specified in this Division and be responsible for the proper operation of electrical powered equipment furnished by this Division.
 - 3. Furnish exact location of electrical connections and information on motor controls to Division 16.
 - 4. Placing the new fuel oil tanks, pumps and oil burner in full operation and continuing their operation during each working day of testing.
 - 5. The satisfactory performance of the completed systems is a requirement of this specification.
- B. Related Work Specified Elsewhere -
 - 1. Conduit, line voltage wiring, outlets, and disconnect switches specified in Division 16.
 - 2. Magnetic starters and thermal protective devices (heaters) not a factory mounted integral part of packaged equipment are specified in Division 16.

1.3 SITE INSPECTION

- A. The Contractor shall examine the site and understand the conditions which may affect the performance of work of this Division before submitting proposals for this work.
- B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine existing site conditions.

1.4 DRAWINGS

- A. Mechanical drawings show general arrangement of fuel oil tanks (UST), pumps, piping, and burner equipment, etc; however, locations are to be regarded as shown diagrammatically only. Follow as closely as actual building construction and work of other trades will permit.
- B. Because of the small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate existing

structural and finished conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

- C. If changes in location of piping, equipment, etc. are required due to lack of coordination of work under this division, such changes shall be made without charge. Contractor shall review drawings with local and state agencies having jurisdiction and any changes required by them shall be brought to the attention of the Engineer prior to bidding or commencement of work.

1.5 CODE REQUIREMENTS, FEES, AND PERMITS

- A. The work shall be installed in accordance with the following applicable codes, ordinances and standards unless otherwise specified. The codes and standards shall include but not be limited to and be of the latest and current editions.

1. American Boiler and Affiliated Industries (AB and AI)
2. Fill ASTM D2940
3. Materials Testing ASTM D2487
4. American National Standards Institute (ANSI)
5. Filler Material ASTM D448
6. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
7. American Society of Mechanical Engineers (ASME)
8. American Society of Testing Materials (ASTM)
9. American Standards Association (ASA)
10. American Welding Society (AWS)
11. Heat Exchange Institute (HEI)
12. National Electrical Code (NEC)
13. National Fire Protection Association (NFPA)
14. Underwriters Laboratories (UL)
15. International Building Code (IBC) 2003 Ed
16. International Mechanical Code (IMC) 2003 Ed
17. International Plumbing Code (IPC) with Utah Amendments 2003 Ed
18. International Energy Conservation Code (IECC) 2003 Ed
19. Utah State Safety Orders (OSHA/UOSH)
20. Utah Fire Rating Bureau
21. Utah Boiler and Pressure Vessel Law
22. Utah Air Conservation Regulations/Waste Disposal regulations.

- B. Should drawings conflict with any code, the code shall govern. If drawings and specifications establish a quality exceeding the code, the drawings and specifications shall govern. If conflicts do exist among the drawings, specifications and codes, the same shall be brought to the attention of the Engineer in writing prior to bidding, otherwise Contractor shall comply with applicable codes.
- C. The latest edition of all codes shall be used.
- D. Contractor shall give all notices, obtain all necessary permits, file necessary plans, prepare documents and obtain approvals, and pay all fees required for

completion of the work outlined in this Division of the specifications and shown on the Drawings.

1.6 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS

- A. Upon completion of work and before final payment, Contractor shall furnish and deliver to the Owner, through the Engineer, Installation, Operation and Maintenance Manuals with instructions for all new materials and equipment used in the building. The contractor shall provide three (3) hard copies of the manuals.
- B. Bind Operation and Maintenance Manual for Mechanical Systems in a hard-backed piano hinge loose-leaf binder with strong sturdy cover. The project name shall be on the spine and the front of the binder. The front of the binder shall include the following information:

OPERATION
AND
MAINTENANCE
MANUAL
for MECHANICAL SYSTEMS of
(Name of Project)
(Location of Project)
(Date of Project Award)
(Name of Architect)

- C. Introduction
 - 1. Title page including name of project, project number, date awarded and date of substantial completion.
 - 2. Second page shall contain the names, phone numbers and addresses of Engineers, Mechanical Contractor, and General Contractor (if required).
 - 3. Third page shall include a Table of Contents for the entire manual.
- D. First Section - Summary
 - 1. First page shall contain the contractor's warranties.
 - 2. Second page shall contain a list of names, addresses and phone numbers of contractors and all sub-contractors and work to which each was assigned.
 - 3. Final page or pages shall contain an equipment list. The list shall contain each item of equipment or material for which a submittal was required giving ID or tag no as contained on the drawings make and model No. Serial No. Identification No. Location, function along with the name, address, and phone number of the supplier.
- E. The second section shall contain Mechanical Equipment O&M data including:
 - 1. Mechanical maintenance schedule, including a lubrication list when necessary.
 - 2. Mechanical Equipment Operation and Maintenance Data including:

- a. Equipment descriptions
 - b. Detailed installation instruction, operating and maintenance instructions. Instructions include in a step by step manner identifying start-up, operating, shutdown and emergency action sequence sufficiently clear so a person unfamiliar with the equipment could perform its operations.
 - c. Equipment drawings, performance curves, operating characteristics, etc.
 - d. Name addresses and phone number of manufacturer, fabricator and local vender clearly printed or stamped on cover.
 - e. Complete parts listing which include catalog number, serial number, contract number or other accurate provision for ordering replacement and spare parts.
 - f. Certified drawings, where applicable, showing assembly of parts and general dimensions.
3. Approved Mechanical submittals
- F. The third section shall contain Controls O&M data including:
1. Sequence of Operation of monitoring and level control and pumps.
 2. Provide wiring diagrams, etc. for oil fired burner system.
- G. See the following checklist for assistance in assembling manual:

| Item # | Description | Y, N, or NA |
|-----------|--|-------------|
| 1. | 3 ring heavy duty binder with Project name, number and date on cover and project name on spine. | |
| 2. | Title Page [including project name, number, address, date awarded, date of substantial completion] | |
| 3. | Second Page Contact List [including architect (if applicable), mechanical engineer, mechanical contractor, and general contractor (if applicable)] | |
| 4. | Table of Contents | |
| 5. | Section 1 - Summary | |
| A. | Warranty | |
| B. | Mechanical's Sub-contractor List | |
| C. | Vendor List | |
| D. | Equipment List | |
| 6. | Section 2 – Mechanical Equipment | |
| A. | Maintenance Schedule (including lubrication list) | |
| B. | Mechanical Equipment O&M Data (for each piece of equipment submitted) per specifications | |
| C. | Approved mechanical submittals | |
| 7. | Section 3 - Controls | |
| A. | Sequence of Operation | |
| B. | Controls diagrams | |

1.7 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Contractor shall instruct building maintenance personnel in the operation and maintenance of the installed mechanical systems utilizing the Operation and Maintenance Manual when so doing.
- B. Minimum instruction period shall be eight hours.
- C. Instruction periods shall occur before final inspection when systems are properly working and before final payment is made.

1.8 RECORD DRAWINGS

- A. See Section 01770 "Closeout Procedures" and Section 0781 "Record Documents".

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 15010

SECTION 15077 - IDENTIFICATION FOR FUEL OIL PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.

1.3 SUBMITTALS

- A. Valve numbering scheme.
- B. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately

larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel self-tapping screws.
- B. Label Content: Include equipment's Drawing. Example: Symbol (FOP-1), GPM, FT HD, Model number.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: At least 1-1/2 inches high.

2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link chain with S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install on fuel oil pumps and manholes on underground storage tanks.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed in existing boiler rooms as follows:
 - 1. Near each valve and control device.
 - 2. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls.
 - 4. Near major equipment items and other points of origination and termination.
 - 5. Spaced at maximum intervals of 25 feet along each run.
- B. Pipe Label Color Schedule:
 - 1. Fuel Oil Piping:
 - a. Background Color: Per SUU's Campus Color scheme.
 - b. Letter Color: Per SUU's Campus Color scheme.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Fuel Oil: 1-1/2 inches, round.
 - 2. Valve-Tag Color:
 - a. Fuel Oil: Natural, or color selected by SUU.
 - 3. Letter Color:

- a. Fuel Oil: Black.

END OF SECTION 15077

SECTION 15126 - METERS AND GAGES FOR FUEL OIL PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Thermometers.
 - 2. Gages.
- B. Related Sections:
 - 1. Division 15 Section "Facility Fuel-Oil Piping".

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Terice, H. O. Co.
 - 2. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
 - 3. Weiss Instruments, Inc.
 - 4. Miljoco Corp.

- B. Case: Die-cast aluminum, 9 inches long.
- C. Tube: Blue reading, organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 THERMOWELLS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Miljoco Corp.
 - 2. Trerice, H. O. Co.
 - 3. Weiss Instruments, Inc.
 - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
 - 5. AMETEK, Inc.; U.S. Gauge Div.
 - 6. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - 7. Marsh Bellofram.
- B. Manufacturers: Same as manufacturer of thermometer being used.
- C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.3 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Miljoco Corp.
 - 2. Trerice, H. O. Co.
 - 3. Weiss Instruments, Inc.
 - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
 - 5. AMETEK, Inc.; U.S. Gauge Div.
 - 6. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - 7. Marsh Bellofram.

- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - 6. Pointer: Black metal.
 - 7. Window: Glass.
 - 8. Ring: Metal.
 - 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
 - 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure (pump inlet gages).
 - 11. Range for Fluids under Pressure: Two times operating pressure.
- C. Pressure-Gage Fittings:
 - 1. Valves: NPS 1/4 brass or stainless-steel needle type.
 - 2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install liquid-filled, in-glass thermometer at suction of each fuel oil pump.
- B. Provide the following temperature ranges for thermometers:
 - 1. Fuel Oil: 0 to 80 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

- A. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install needle-valve and snubber fitting in piping for each pressure gage.

- E. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION 15126

SECTION 15192 - FACILITY FUEL-OIL PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes No. 2 fuel-oil and vent piping distribution system above and below grade, and the following:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping joining materials.
 - 3. Piping specialties.
 - 4. Valves.
 - 5. FRP fuel-oil USTs.
 - 6. Fuel-oil UST accessories.
 - 7. Fuel-oil storage tank piping specialties.
 - 8. Fuel-oil storage tank pumps.
 - 9. Fuel-transfer pumps.
 - 10. Fuel maintenance system.
 - 11. Liquid-level gage system.
 - 12. Leak-detection and monitoring system.
 - 13. Mechanical sleeve seals.
 - 14. Grout.
 - 15. Concrete bases.

1.3 DEFINITIONS

- A. Exposed, Interior Installations: Exposed to view indoors. Examples include boiler rooms.
- B. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include vent piping and manhole covers.
- C. FPM: Vinylidene fluoride-hexafluoropropylene copolymer rubber.
- D. FRP: Glass-fiber-reinforced plastic.
- E. UST: Underground storage tank.

1.4 PERFORMANCE REQUIREMENTS

- A. Maximum Operating-Pressure Ratings: 100-psig fuel-oil supply pressure at oil-fired burner.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, and dimensions of individual components and profiles. Also include, where applicable, rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 1. Piping specialties.
 - 2. Valves: Include pressure rating and capacity.
 - 3. Type and size of fuel-oil storage tank. Indicate dimensions, weights, loads, components, and location and size of each field connection.
 - 4. Fuel-oil storage tank accessories.
 - 5. Fuel-oil storage tank piping specialties.
 - 6. Fuel-oil transfer pumps.
 - 7. Fuel maintenance system.
 - 8. Liquid-level gage system.
 - 9. Leak-detection and monitoring system.
- B. Welding certificates.
- C. Field quality-control reports for testing, and tank diameter measurements as required. See installation notes on sheet ME502.
- D. Operation and Maintenance Data: For fuel-oil equipment and accessories to include in operation and maintenance manuals.
- E. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with ASME B31.9, "Building Services Piping," for fuel-oil piping materials, installation, testing, and inspecting.

- E. Comply with requirements of the EPA and of state and local authorities having jurisdiction. Include recording of fuel-oil storage tanks and monitoring of tanks and piping.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Lift and support fuel-oil storage tanks only at designated lifting or supporting points, as shown on the Drawings. Do not move or lift tanks unless empty. Do not wrap chain or cable around the tanks.
- B. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store piping with protective PE coating to avoid damaging the coating and to protect from direct sunlight.
- D. Store PE pipes protected from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Fuel-Oil Service: Do not interrupt the No. 5 fuel-oil service to Boilers 1 & 3 unless permitted under the following conditions and then only after arranging to provide temporary fuel-oil supply according to requirements indicated:
 - 1. Notify Owner no fewer than 72 hours in advance of proposed interruption of existing fuel-oil service.
 - 2. Do not proceed with interruption of existing fuel-oil service without Owner's written permission.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-oil storage tanks and double-containment piping and related equipment that fail in materials or workmanship within specified warranty period.
 - 1. Storage Tanks:
 - a. Failures include, but are not limited to, the following when used for storage of No. 2 fuel oil:
 - 1) Structural failures including cracking, breakup, and collapse and internal and external corrosion.

- b. Warranty Period: 30 years from date of Substantial Completion.
- 2. Double-Containment Piping:
 - a. Failures due to defective materials or workmanship for materials installed together.
 - b. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

- A. See Part 3 piping schedule articles for where pipes, fittings, and joining materials are applied in various services.
- B. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B for vent piping and interior above grade fuel oil piping.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern interior piping only.
 - 2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends interior piping only.
 - 3. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings: FRP to steel connections.
 - a. Material Group: 1.1.
 - b. End Connections: Threaded.
 - c. Gasket Materials: Asbestos free, ASME B16.20 metallic, or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.
 - d. Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.
 - 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE, underground vent piping.

2.2 DOUBLE-CONTAINMENT PIPE AND FITTINGS

- A. Rigid, Double-Containment Piping: Comply with UL 971.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ameron International; Fiberglass Pipe Group.
 - b. Conley Corporation.
 - c. Perma-Pipe, Inc.
 - d. Smith Fibercast.
 - e. Prior approved equal.

2. RTRP: ASTM D 2996 or ASTM D 2997 carrier and containment piping and mechanical couplings to seal carrier and containment piping or individually bonded joints.
 - a. Minimum Operating-Pressure Rating for RTRP NPS 2: 150 psig.
 - b. Fittings: RTRF complying with ASTM D 2996 or ASTM D 2997, and made by RTRP manufacturer; watertight sump entry boots, termination, or other end fittings.
3. Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.

2.3 PIPING SPECIALTIES

A. Basket Strainers: Dual.

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Flanged ends.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 150 psig.
5. Precision machined plug valves for easy bypass.
6. Tate and Dale model ID twin basket strainers.
7. Prior approved equal.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

2.4 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for fuel oil.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Bonding Adhesive for FRP Piping: As recommended by fiberglass piping manufacturer.

2.5 MANUAL FUEL-OIL SHUTOFF VALVES

- A. See valve schedule in Part 3 for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller for Liquid Service: Comply with UL 842.
 - 1. CWP Rating: 125 psig.
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Tamperproof Feature: Locking feature for valves indicated in the valve schedule.
 - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kitz.
 - b. BrassCraft Manufacturing Company; a Masco company.
 - c. Conbraco Industries, Inc.; Apollo Div.
 - 2. Body: Bronze, complying with ASTM B 584.
 - 3. Ball: Chrome-plated bronze.
 - 4. Stem: Bronze; blowout proof.
 - 5. Seats: Reinforced TFE; blowout proof.
 - 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 - 7. Ends: Threaded.
 - 8. CWP Rating: 600 psig.
 - 9. Service Mark: Initials "WOG" shall be permanently marked on valve body.

2.6 SPECIALTY VALVES

- A. Pressure Relief Valves: Comply with UL 842.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anderson Greenwood; Division of Tyco Flow Control.
 - b. Fulflo Specialties, Inc.
 - c. Webster Fuel Pumps & Valves; a division of Capital City Tool, Inc.
 - d. Prior approved equal.
 - 2. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - 3. Body: Brass, bronze, or cast steel.
 - 4. Springs: Stainless steel, interchangeable.
 - 5. Seat and Seal: Nitrile rubber.
 - 6. Orifice: Stainless steel, interchangeable.
 - 7. Factory-Applied Finish: Baked enamel.

2.7 FRP FUEL-OIL UST

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Xerxes Corporation.
 - 2. Containment Solutions, Inc.
 - 3. Prior approved equal.
- B. Governing Standards, as applicable.
 - 1. Underwriters Laboratories (UL) Standard for Safety 1316, File MH 9061 for storage of flammable liquids. A UL label shall be attached to each tank.
 - 2. National Fire Protection Associate (NFPA) Standards:
 - a. NFPA 30: Flammable and Combustible Liquids Code.
 - b. NFPA 31: Installation of Oil-Burning Equipment.
- C. Description: Horizontal, FRP UST; UL 1316, double wall, with dry interstitial space and leak-detection and monitoring system.
- D. Construction: Fabricated with 100% resin and glass-fireber reinforcement. No sand fillers; suitable for operation at atmospheric pressure; fabricated for the following loads:
 - 1. Depth of Bury: 4 feet from top of tank to finished surface.
 - 2. Surface Loads: AASHTO's "Specifications for Highway Bridges," H-20 axle loads of 32,000 lb.
 - 3. Loading conditions - Tank shall meet the following design criteria:
 - a. Internal Load - Tank shall withstand a 5-psig air-pressure test with 5:1 safety factor. Contractor shall individually test tanks for leakage prior to installation. Maximum test pressure is 5 psig.
 - b. Vacuum Test - To verify structural integrity, tank shall be vacuum tested by the manufacturer at the factory to 11.5" of mercury.
 - c. Surface Loads - Tank shall withstand surface H-20 axle loads when properly installed according to manufacturer's current Installation Manual and Operating Guidelines.
 - d. External Hydrostatic Pressure - Tanks shall be capable of being buried in ground with 4' of overburden over the top of the tank, the hole fully flooded and a safety factor of 5:1 against general buckling.
- E. Capacities and Characteristics:
 - 1. Capacity: 15,000 gal each.
 - 2. Diameter: 10' - 4".
 - 3. Length: 29' - 5-3/4".
 - 4. Connection Sizes:
 - a. Fill Line: 4" NPS.
 - b. Vent Line: 4" NPS.
 - c. Outlet: 4" NPS.

- d. Return: 4" NPS.
 - e. Gage: 4" NPS.
 - f. Sounding: 4" NPS.
- 5. Manholes:
 - a. Number Required: One.
 - b. Diameter: 22 inch.
- 6. Product Storage:
 - a. Fuel-Oil Grade Number: No. 2.
 - b. Tanks shall be capable of storing No. 2 Fuel Oil.
 - c. Tanks shall be vented to atmospheric pressure.
 - d. Tanks shall be capable of storing products identified in the manufacturer's current standard limited warranty.
- 7. Interstitial Space:
 - a. Tank shall have a dry space between the primary and secondary walls to allow for the free flow and containment of leaked product from the primary tank. The space also allows the insertion of a monitoring device through a monitoring fitting.

2.8 FUEL-OIL UST ACCESSORIES

- A. Tank Manholes: 22-inch diameter; bolted, flanged, and UL-listed gaskets, with extension collar; for access to inside of tank. Locate as shown on tank drawings.
- B. Threaded pipe connection fittings on top of tank for fill, supply, return, vent, sounding, and gaging, in locations and of sizes indicated. Include cast-iron plugs for shipping and testing.
 - 1. All tank threaded fittings shall be half-couplings and shall be 4"-diameter. Reducers are to be used for smaller sizes where shown and provided by contractor.
 - 2. Strength - NPT fittings shall withstand a minimum of 150 foot-pounds of torque and 1,000 foot-pounds of bending, both with a 2:1 safety factor.
- C. Striker Plates: Inside tank, on bottom below piping indicated on drawings.
- D. Lifting Lugs: For handling and installation, located in shop by manufacturer.
- E. Fill Tube:
 - 1. Fill tubes shall be FRP, 4"-diameter with a 6" x 4" double-tapped reducer bushing, and include a 6" NPT fitting. Tubes shall terminate a minimum of 6" from the bottom of tank.
- F. Sounding Tubes: Extension of fitting into tank, terminating 6 inches above tank bottom and cut at a 45-degree angle.

- G. Containment Sumps: Fiberglass with sump base, add-on extension pieces as required, sump top, lid, and gasket-seal joints.
- H. Anchor Straps: Storage tank manufacturer's standard anchoring system, with FRP anchor straps, cables and turnbuckles, of strength at least one and one-half times maximum uplift force of empty tank without backfill in place.
- I. Overfill Prevention Valves: Factory fabricated or shop or field assembled from manufacturer's standard components. Include drop tube, cap, fill nozzle adaptor, check valve mechanism or other devices, and vent if required to restrict flow at 95 percent of tank capacity and to provide complete shutoff of filling at 95 percent of tank capacity.

2.9 FUEL-OIL STORAGE TANK PIPING SPECIALTIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. OPW.
 - 2. EBW, Inc.
 - 3. Environ Products, Inc.
- B. Fitting Materials: Cast iron or corrosion-resistant metal; suitable for fuel-oil service.
- C. Spill-Containment Fill Boxes: Flush mounting, with drainage feature to drain oil into tank, threaded fill-pipe connection, and wrench operation.
- D. Locking Fill Boxes: Flush mounting, with locking-type inner fill cap for standard padlock and threaded fill-pipe connection. See detail on drawings. OPW 104A-1200 with OPW 634TT top seal cap and OPW 633 T adapter.
- E. Supply and Sounding Drop Tubes: Fuel-oil supply piping or fitting, inside tank, terminating 6 inches above bottom of tank, and with end cut at a 45-degree angle.
- F. Pipe Adapters and Extensions: Compatible with piping and fittings.
- G. Check Valves: Bronze or corrosion-resistant metal components.
- H. Foot Valves and Antisiphon Check Valves: Poppet-type, bronze or corrosion-resistant metal components.
- I. Weatherproof Vent Cap: Aluminum Body with brass 40 mesh wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection. See detail on drawings.
- J. Metal Manholes: 22-inch diameter frame and cover.
- K. Monitoring Well: Locking pipe adapter and cap. See detail on drawings. Provide wire grommet fittings on top of cap. OPW 62M 0500 or 62M-0375 depending on size of wire used.

2.10 FUEL-OIL TRANSFER PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Fuel-Oil Transfer Pumps:
 - a. Tuthill Corporation Model 5LE88606 or equal by:
 - b. Viking Pump Inc.; a Unit of IDEX Corporation.
 - c. Webster Fuel Pumps & Valves; a division of Capital City Tool, Inc.
 - d. Suntec Industries Incorporated.
- B. Description: Comply with UL 343, and HI M109.
1. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 2. Type: Positive-displacement, rotary type.
 3. Housing: Cast-iron foot mounted: ASTM A 48-96a.
 4. Housing Bushing: Steel A1S1 12L14.
 5. Cover: Cast Iron - ASTM A 48-96a.
 6. Rotor: Steel - ASTM A311.
 7. Idler: P/M steel - MP1F-0508-P.
 8. Idler Pin: Steel - C1117.
 9. Idler Bushing: Bronze - SAE 660.
 10. Housing Plugs: Steel - AISI 12L14.
 11. Gaskets: Oriented polyester.
 12. O-Rings: Buna -
- C. Drive: Direct, close coupled.
- D. Controls:
1. Run pump on seven-day schedule.
 2. Alarm motor failure.
 3. Manual reset dry-run protection. Stop pump if fuel level falls below pump suction.
 4. Deenergize and alarm pump locked rotor condition.
 5. Indicating lights for power on, run, and off normal conditions.
 6. Interface with existing automatic control system to control and indicate the following:
 - a. Start/stop pump set when required by schedule.
 - b. Operating status.
 - c. Alarm off-normal status.
 - d. Alternate pumps to equalize run time.
 - e. On pump failure controls will alarm and start 2nd pump.
- E. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
1. Motor Sizes: Minimum size as indicated.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 16 Sections.

2.11 COMBINATION LEAK-DETECTION AND TANK LEVEL MONITORING SYSTEM

A. Cable and Sensor System: Comply with UL 1238.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. OPW.
 - b. Veeder-Root; a Danaher Corporation Company.
 - c. Containment Solutions, Inc.
 - d. In-Situ, Inc.
 - e. MSA; Instrument Div.
 - f. Raychem Corp; Tyco Electronics Corporation.
2. Calibrated, leak-detection and monitoring system with probes and other sensors and remote alarm panels for each fuel-oil storage tank and fuel-oil piping.
3. Include fittings and devices required for testing.
4. Controls: Electrical, operating on 120-V ac.
5. Calibrated, liquid-level gage complying with UL 1238 with probes.
6. Remote Annunciator Panel: With visual and audible, high-tank-level and low-tank-level alarms, fuel indicator with registration in gallons, and overfill alarm. Include gage volume range that covers fuel-oil storage capacity.
7. Controls: Electrical, operating on 120-V ac.

2.12 FUEL OIL

A. Fuel Oil: ASTM D 396, Grade No. 2.

2.13 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends.

2.14 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Link Seal or approved by:

- b. Metraflex Company (The).
 - c. Pipeline Seal and Insulator, Inc.
- 2. Sealing Elements: Interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
- 3. Pressure Plates: Carbon steel.
- 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.15 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall escutcheons with ID to fit around pipe or tube and with OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn brass with polished chrome-plated finish.

2.16 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Posthardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.17 CONCRETE MANHOLES

- A. Precast Concrete Manhole Sections: ASTM C 478, base and concentric-cone sections sized as shown on the drawings. Leave 6 inches between bottom of manhole and FRP underground storage tank (UST).
- B. Cast-Iron Frame and Cover: Heavy-duty, water-resistant, cast-iron manhole frame, gasket, and bolted cover; 30-inch- diameter, inside opening dimension.

2.18 SOURCE QUALITY CONTROL

- A. Pressure test and inspect fuel-oil storage tanks at factory, after fabrication and before shipment, according to ASME and the following. Contractor shall make all tests in the field according to installation notes on sheet ME502.
 - 1. FRP Double wall USTs: UL 1316.
- B. Affix standards organization's code stamp.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for fuel-oil piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

- A. Comply with requirements in Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.3 PREPARATION

- A. Close equipment shutoff valves before turning off existing fuel oil to boiler #2.
- B. Comply with NFPA 30 and NFPA 31 requirements for prevention of accidental ignition.

3.4 OUTDOOR PIPING INSTALLATION

- A. Install underground fuel-oil piping buried at least 36 inches below finished grade. Comply with requirements in Division 2 Section "Earthwork" for excavating, trenching, and backfilling.
- B. Steel Piping with Protective Coating: Vent piping.
 - 1. Apply joint cover kits to pipe after joining, to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer. Review protective coating damage with Engineer prior to repair.
 - 3. Replace pipe having damaged PE coating with new pipe.
- C. Install double-containment, fuel-oil pipe at a minimum slope of 1 percent downward toward fuel-oil storage tank.
- D. Install vent pipe at a minimum slope of 2 percent downward toward fuel-oil storage tank.
- E. Install fittings for changes in direction in rigid pipe.
- F. Install system components with pressure rating equal to or greater than system operating pressure.
- G. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for

1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

- H. Mechanical Sleeve Seal Installation: Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- I. Install pressure gage on suction and discharge from each pump. Pressure gages are specified in Division 15 Section "Meters and Gages."

3.5 INDOOR PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping at right angles and parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- C. Install piping free of sags and bends.
- D. Install fittings for changes in direction and branch connections.
- E. Install escutcheons for penetrations of walls.
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Piping at Wall: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Piping in Equipment Rooms: One-piece, cast-brass type.
- F. Verify final equipment locations for roughing-in.
- G. Prohibited Locations:
 - 1. Do not install fuel-oil piping in solid walls or partitions.
- H. In horizontal piping use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- I. Connect branch piping from bottom of horizontal piping.
- J. Install unions in pipes NPS 2 and smaller at final connection to existing burner piping. Unions are not required on flanged devices.
- K. Do not use fuel-oil piping as grounding electrode.

- L. Install dual basket strainers on inlet side of fuel-oil pumps.

3.6 VALVE INSTALLATION

- A. Install manual fuel-oil shutoff valves as shown on the drawings.
- B. Install valves in accessible locations.
- C. Protect valves from physical damage.
- D. Install metal tag attached with metal chain indicating fuel-oil piping systems.
- E. Identify valves as specified in Division 15 Section "Mechanical Identification."
- F. Install pressure relief valves in distribution piping between the supply and return lines.
- G. Install one-piece, bronze ball valve with hose end connection at low points in fuel-oil piping.
- H. Install manual air vents at high points in fuel-oil piping.

3.7 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Flanged Joints: Install gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.
- E. Fiberglass-Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.8 FUEL-OIL UST INSTALLATION

- A. Install UST as shown on the drawings and as noted on sheet ME502.

- B. Excavate as shown on the drawings with a minimum of 4 feet of earth cover from top of tank to finished grade. Allow for 12" reinforced, concrete-ballast base plus 12 inches of pea gravel between concrete base and tank. Extend excavation at least 5 feet-2 inches around perimeter of tank. See drawings.
- C. Set tie-down eyelets for hold-down straps in concrete base and tie to reinforcing steel.
- D. Place 12 inches of pea gravel on top of concrete base.
- E. Set tank on fill materials and install hold-down straps.
- F. Connect piping.
- G. Install tank leak-detection and monitoring devices.
- H. Install containment sumps.
- I. Backfill excavation with pea gravel in lifts as shown on the drawings. Compact each layer to 95% compaction.
- J. Install FRP USTs with FRP hold-down straps, manhole extensions, and manhole risers.
- K. Fill storage tanks with No. 2 fuel oil.

3.9 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support and equipment support materials and installation requirements are as shown on the drawings.
- B. Install supports for interior horizontal steel piping with the following maximum spacing:
 - 1. NPS 1-1/2: Maximum span, 108 inches.
 - 2. NPS 2: Maximum span, 10 feet.

3.10 FUEL-OIL PUMP INSTALLATION

- A. Transfer Pumps:
 - 1. Install pumps with access space for periodic maintenance including removal of motors and accessories.
 - 2. Set pumps on and anchor to concrete base.
- B. Install two-piece, full-port ball valves at suction and discharge of pumps.
- C. Install mechanical leak-detector valves at pump discharge.
- D. Install dual basket strainer on inlet side of fuel-oil pumps.
- E. Install check valve on discharge of fuel-oil pumps.

- F. Install suction piping with minimum fittings and change of direction.
- G. Install vacuum and pressure gage, upstream and downstream respectively, at each pump to measure the differential pressure across the pump. Pressure gages are specified in Division 15 Section "Meters and Gages."

3.11 LEAK-DETECTION AND MONITORING SYSTEM INSTALLATION

- A. Install leak-detection and monitoring system. Install panel inside building where indicated.
 - 1. Double-Wall, Fuel-Oil Storage Tanks: Install probes in interstitial space.
 - 2. Double-Containment, Fuel-Oil Piping: Install leak-detection sensor probes in low points in piping.
 - 3. Install control panels for each tank. See detail on drawings.

3.12 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.
- C. Install flanges for transition between double wall FRP piping and steel piping. See detail on drawings.
- D. Connect piping to equipment with ball valve and union. Install union between valve and equipment.

3.13 FIELD PAINTING OF ABOVEGROUND PIPING

- A. Paint exposed, interior metal piping, valves, and piping specialties, except components with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (semigloss).
 - d. Color: Approved by SUU.
 - 2. Alkyd System: MPI INT 5.1E.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd (semigloss).
 - d. Color: Approved by SUU.

- B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.14 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases for pumps and UST of dimensions indicated.
 - 2. Install dowel rods to connect concrete base for pumps to concrete floor. Unless otherwise indicated, install dowel rods on 9-inch each corner and middle of concrete base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Install anchor bolts to elevations required for proper attachment to pump base.
 - 5. Use 3000-psi, 28-day, compressive-strength concrete and reinforcement as shown on the drawings.

3.15 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections for the existing fuel oil burner, after all items and wiring are installed.
- B. Manufacturer's service representative shall also start the burner after alteration of the piping, burner, controls and electrical are completed.
- C. Tests and Inspections:
 - 1. Tanks: Minimum or compressed-air test pressures for fuel-oil storage tanks as required by installation notes on sheet ME502.
 - a. Double-Wall Tanks:
 - 1) Inner Tanks: Minimum 3 psig and maximum 5 psig.
 - 2) Interstitial Space: Minimum 3 psig and maximum 5 psig, or 5.3-in. Hg vacuum.
 - b. Maintain the test pressure for one hour.
 - 2. Piping: Minimum hydrostatic or pneumatic test-pressures measured at highest point in system:
 - a. Fuel-Oil, Double-Containment Piping:
 - 1) Carrier Pipe: Minimum 5 psig for minimum 30 minutes.
 - 2) Containment Conduit: Minimum 5 psig for minimum 60 minutes.
 - b. Suction Piping: Minimum 20-in. Hg for minimum 30 minutes.

- c. Isolate storage tanks if test pressure in piping will cause pressure in storage tanks to exceed 10 psig.
- 3. Inspect and test fuel-oil piping according to NFPA 31, "Tests of Piping" Paragraph; and according to requirements of authorities having jurisdiction.
- 4. Test liquid-level panel for accuracy by manually measuring fuel-oil levels at not less than four different depths while filling tank and checking against gage indication.
- 5. Test leak-detection and monitoring system for accuracy by manually operating sensors and checking against alarm panel indication.
- 6. Start fuel-oil transfer pumps to verify for proper operation of pump and check for leaks.
- 7. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- 8. Bleed air from fuel-oil piping using manual air vents.
- D. Fuel-oil piping and equipment will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.16 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain leak-detection and monitoring systems and fuel-oil pumps.

3.17 OUTDOOR PIPING SCHEDULE

- A. Underground fuel-oil piping shall be the following. Size indicated is carrier-pipe size.
 - 1. Rigid, double-containment piping.
- B. Underground vent piping shall be the following:
 - 1. NPS 2 and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints. Coat pipe and fittings with protective coating for steel piping.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.18 INDOOR PIPING SCHEDULE

- A. Aboveground fuel-oil piping shall be the following:
 - 1. NPS 1/2 and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.
 - 2. NPS 5/8 to NPS 2: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.

3. Steel pipe with malleable-iron fittings and threaded joints.

3.19 ABOVEGROUND MANUAL FUEL-OIL SHUTOFF VALVE SCHEDULE

- A. Distribution piping valves for pipe NPS 2 and smaller shall be the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Valves in branch piping for single appliance shall be the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 15192

SECTION 15512 - OIL BURNER MODIFICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes modifying the existing Coen gas and No. 6 oil fired burner to fire No. 2 oil along with all accessories for generating steam with the following changes:
 - 1. Field installed new parts for conversion of existing burner to No. 2 oil.

1.3 SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: For modified burner.
 - 1. Wiring Diagrams: Power, signal, and control wiring. Factory supplied.
- C. Operation and Maintenance Data: For new parts to include in operation and maintenance manuals.
- D. Warranty: Standard, See paragraph 1.6, A-1.
- E. Other Informational Submittals:
 - 1. Startup service reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASME Compliance.
- C. ASHRAE/IESNA 90.1 Compliance: Modified burner shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Boilers."
- E. UL Compliance: Test for compliance with UL 726, "Oil-Fired Boiler Assemblies." Modified burner shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

- A. Coordinate new parts and wiring with existing burner and field conditions.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the new parts and wiring used for the modification of the existing burner that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Existing burner was manufactured by Coen. All new parts, wiring, and accessories required by the burner conversion shall be provided by Coen.

2.2 MANUFACTURED UNITS

- A. Description: Parts shall be factory provided and field assembled and installed.

2.3 BURNER (EXISTING COMBINATION GAS/OIL) MODIFICATION

- A. Burner: Conversion parts and accessories.
 - 1. CPF #1022-488-057.0 oil gun assembly - existing.
 - 2. Jumper out the oil temperature limits.
 - 3. Disconnect the existing recirculation valve.
 - 4. Provide new re-mix nozzle body; see Coen for part number.
 - 5. Provide nozzle cap; see Coen for part number.
 - 6. Provide oil restrictor; see Coen for part number.
 - 7. Provide new wiring; see Coen for new wiring diagrams.
 - 8. Provide new trial caps as needed. See Coen for part number.

2.4 TRIM

- A. Connect to new No. 2 oil piping.

2.5 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Provide new oil burner electrical per new wiring diagrams provided by Coen.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Before burner modifications and cleaning of existing No. 6 oil piping, etc, Contractor shall examine piping and electrical connections to verify actual locations, sizes, and other conditions affecting burner modifications.
- B. Proceed with modification and cleaning only after unsatisfactory conditions have been corrected.

3.2 BURNER RENOVATION FOR NO. 2 OIL

- A. Remove and clean exiting factory oil piping assembly and equipment.
- B. Install all new parts required in paragraph 2.3 in this Section.
- C. Provide all new wiring required by Coen.
- D. Assemble and install removed oil piping noted in "A" above.
- E. Connect burner oil piping assembly to new building No. 2 fuel oil piping.
- F. Reconnect all existing control wiring.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install new fuel oil piping adjacent to boiler to allow service and maintenance.
- C. Connect oil piping full size to burner inlet with shutoff valve and union.
- D. Ground equipment according to Division 16 Section "Grounding and Bonding."
- E. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Contact Allan Woodbury at North Associates, (801) 274-3333.
- B. Tests and Inspections:
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.
 - b. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and steam pressure.
 - c. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Performance and Start-Up Tests:
 - 1. Engage a factory-authorized service representative (See Allan Woodbury at North Associates) to inspect component assemblies and equipment installations, including connections, and to conduct start-up and performance testing.
 - 2. Perform field performance tests to determine capacity and efficiency of converted oil burner.
 - a. Test for full capacity.
 - b. Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40, and 20 percent of full capacity. Determine efficiency at each test point.
 - 3. Repeat tests until results comply with requirements.
 - 4. Provide analysis equipment required to determine performance.
 - 5. Notify Engineer in advance of test dates.
 - 6. Document test results in a report and submit to Engineer.

3.5 DEMONSTRATION

- A. Engage the same factory-authorized service representative as above to train Owner's maintenance personnel to adjust, operate, and maintain updated No. 2 oil burner. Refer to Division 1 Section "Demonstration and Training."

DIVISION 16
ELECTRICAL

| | |
|-------|--------------------------------------|
| 16001 | ELECTRICAL GENERAL PROVISIONS |
| 16070 | ELECTRICAL CONNECTIONS FOR EQUIPMENT |
| 16080 | DEMOLITION |
| 16110 | CONDUIT RACEWAYS |
| 16120 | CONDUCTORS AND CABLES |
| 16135 | ELECTRICAL BOXES AND FITTINGS |
| 16136 | SUPPORTING DEVICES |
| 16155 | MOTOR STARTERS |
| 16170 | MOTOR AND CIRCUIT DISCONNECTS |
| 16180 | OVERCURRENT PROTECTIVE DEVICES |
| 16452 | GROUNDING |
| 16610 | EMERGENCY ELECTRICAL SYSTEMS |

SECTION - 16070 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical connection for equipment includes final electrical connection of all equipment having electrical requirements. Make final connections for all owner furnished equipment. See other applicable portions of specification for building temperature control wiring requirements.
- B. Refer to Division-15 sections for motor starters and controls furnished integrally with equipment; not work of this section.
- C. Refer to Division-15 section for control system wiring; not work of this section.
- D. Refer to sections of other Divisions for specific individual equipment power requirements.

1.3 QUALITY ASSURANCE:

- A. NEC COMPLIANCE: Comply with applicable portions of NEC as to type products used and installation of electrical power connections.
- B. UL LABELS: Provide electrical connection products and materials which have been UL-listed and labeled.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, raceways, conductors, cords, cord caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices, terminations, and connections as required. Crimp on or slip-on type splicing materials (insulation displacement type) designed to be used without wire stripping are not acceptable. See Section 16110, Conduit Raceways; Section 16140 Wiring Devices; and Section 16120 Wire and Cable for additional requirements. Provide final connections for equipment consistent with the following:

- B. Permanently installed fixed equipment - flexible seal-tite conduit from branch circuit terminal equipment, or raceway; to equipment, control cabinet, terminal junction box or wiring terminals. Totally enclose all wiring in raceway.
- C. Movable and/or portable equipment - wiring device, cord cap, and multi-conductor cord suitable for the equipment and in accordance with NEC requirements (Article 400).
- D. Other methods as required by the National Electrical Code and/or as required by special equipment or field conditions.

PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS:

- A. Make electrical connections in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.
- B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams.
- C. Coordinate installation of electrical connections for equipment with equipment installation work.
- D. Verify all electrical loads (voltage, phase, full load amperes, number and point of connections, minimum circuit ampacity, etc.) for equipment furnished under other Divisions of this specification, by reviewing respective shop drawings furnished under each division. Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics. Report any variances from electrical characteristics noted on the electrical drawings to Architect before proceeding with rough-work.
- E. Obtain and review the equipment shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.
- F. Refer to basic materials and methods Section 16120, Conductors, for identification of electrical power supply conductor terminations.

END OF SECTION 16070

SECTION 16080 – DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Special Provisions, Division 1 and Division-2A Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to demolition.

1.2 DESCRIPTION OF WORK:

- A. Extent of major items of demolition work is indicated by drawings. Other demolition work shall be performed as required to maintain system operation.
- B. The intent of the drawings is to indicate major items affected and not to show every device, outlet, fixture, etc. affected by demolition work.
- C. The drawings do not necessarily reflect as-built conditions. The contractor shall visit the jobsite prior to bidding to determine the overall scope of demolition work.
- D. Refer to sections of other Divisions for applicable requirements affecting demolition work.
- E. Refer to Section 16001 for requirements with regard to power outages affecting the operation of existing electrical systems.

1.3 QUALITY ASSURANCE:

- A. NEC COMPLIANCE:
 - 1. Comply with applicable portions of NEC as to methods used for demolition work.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Demolition work shall be laid out in advance to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary, perform with care, use skilled mechanics of the trades involved. Repair damage to building and equipment. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting of structural members shall not be permitted.

2.2 PATCHING AND REPAIR

- A. The Contractor is responsible for all demolition, patching and repair of all finished interior surfaces pertaining to the installation of this particular phase of work. All surfaces shall be finished (painted, etc.) to match the adjacent materials, finishes and colors.
- B. Hard surfaces: Whenever demolition or excavation is required for the installation of the electrical system, it shall be the responsibility of this contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, roofing, etc.
- C. The method of patching and repair shall follow good construction practices and all finished surfaces shall match materials and finish wherein the demolition occurred.

2.3 EXISTING EQUIPMENT

- A. The following is a part of this project and all costs pertaining thereto shall be included in the base bid.
- B. The new electrical equipment and apparatus shall be coordinated and connected into the existing system as required. Auxiliary systems shall comply, unless otherwise specified.
- C. The existing electrical devices, conduit and/or equipment that for any reason obstructs construction shall be relocated. Provide conduit, wiring, junction boxes, etc. as required to extend existing circuits and systems to relocated devices or equipment.
- D. When installing equipment in the existing building, it shall be concealed.
- E. All existing electrical equipment and systems in portions of the building not being remodeled shall be kept operational, in service and in working condition throughout the entire construction period. Restore any circuits and systems interrupted. Provide temporary panels, temporary wiring and conduit, etc. as required.
- F. Maintain circuit integrity and continuity of all existing circuits and systems that interfere with or are interrupted by remodel work unless those circuits are to be abandoned completely. Maintain all circuits and systems in operation during construction. Provide temporary panels, temporary wiring and conduit, etc. as required.
- G. Existing raceways may be used where possible in place, except as noted. All circuits, conduit and wire that are not used in the remodeled area shall be removed back to the panelboard, where it shall be labeled a spare with circuit number indicated. Re-used raceway shall meet all requirements for new installations.

- H. Obtain permission from the Architect and Owner's representative before penetrating any ceiling, floor, and wall surfaces.
- I. Any and all equipment having electrical connections that require disconnecting and reconnection at the same or another location throughout the course of construction shall be included as part of this contract.

END OF SECTION 16080

SECTION 16110 - CONDUIT RACEWAYS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to electrical raceways and specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of raceways is indicated by drawings and schedules.
- B. Types of raceways in this section include the following:
 - 1. Electrical Metallic Tubing
 - 2. Flexible Metal Conduit
 - 3. Intermediate Metal Conduit
 - 4. Liquid-tight Flexible Metal Conduit
 - 5. Rigid Metal Conduit
 - 6. Rigid Non-metallic Conduit

1.3 QUALITY ASSURANCE:

- A. MANUFACTURERS: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. STANDARDS: Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.
- C. SUBMITTALS: Not required.

PART 2 – PRODUCTS

2.1 METAL CONDUIT AND TUBING:

- A. GENERAL:
 - 1. Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4".

- B. RIGID METAL CONDUIT (RMC): FS WW-C-0581 and ANSI C80.1.
- C. INTERMEDIATE STEEL CONDUIT (IMC): FS WW-C-581.
- D. PVC EXTERNALLY COATED RIGID STEEL CONDUIT: ANSI C80.1 and NEMA Std. Pub. No. RN 1.
- E. ALUMINUM CONDUIT: Not acceptable.
- F. MC CABLE: Not acceptable.
- G. RIGID AND INTERMEDIATE STEEL CONDUIT FITTINGS:
 - 1. Provide fully threaded malleable steel couplings; rain tight and concrete tight where required by application. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.
- H. ELECTRICAL METALLIC TUBING (EMT): FS WW-C-563 and ANSI C80.3.
- I. EMT FITTINGS:
 - 1. Provide insulated throat nylon bushings with non-indenter type malleable steel fittings at all conduit terminations. Install OZ Type B bushings on conduits 1" larger. Cast or indenter type fittings are not acceptable.
- J. FLEXIBLE METAL CONDUIT: FS WW-C-566, of the following type;
 - 1. Zinc-coated steel.
- K. FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 1, and Style A.
- L. LIQUID TIGHT FLEXIBLE METAL CONDUIT:
 - 1. Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).
- M. LIQUID-TIGHT FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 3, Style G.
- N. EXPANSION FITTINGS: OZ Type AX, or equivalent to suit application.

2.2 NON-METALLIC CONDUIT AND DUCTS:

- A. GENERAL:
 - 1. Provide non-metallic conduit, ducts and fittings of types, sizes and

weights as indicated; with minimum trade size of 3/4".

B. UNDERGROUND PVC PLASTIC UTILITIES DUCT:

1. Minimum requirements shall be schedule 40 for encased burial in concrete and for Type II for direct burial.

C. PVC AND ABS PLASTIC UTILITIES DUCT FITTINGS:

D. ANSI/NEMA TC 9, match to duct type and material.

E. HDPE CONDUIT: Not acceptable.

2.3 CONDUIT; TUBING; AND DUCT ACCESSORIES:

- A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing. Provide manufactured spacers in all duct bank runs.

2.4 SEALING BUSHINGS:

- A. Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ type CSB internal sealing bushings.

2.5 CABLE SUPPORTS:

- A. Provide OZ cable supports for vertical risers, type as required by application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

- A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and in accordance with the following:

1. SERVICE ENTRANCE CONDUCTORS, AND CONDUCTORS OVER 600 VOLTS:

- a. Install in rigid metal conduit (RMC), or intermediate metal conduit (IMC); except where buried below grade, install in non-metallic conduit or duct, individually encased in concrete. See duct banks.

2. FEEDERS UNDER 600 VOLTS:

- a. Install feeders to panels and motor control centers and individual equipment feeders rated 100 amps and greater, in rigid metal conduit (RMC), or intermediate metal conduit (IMC); except where buried below grade, install in non-metallic conduit or duct. Encase feeders 1-1/4" and larger, individually in concrete where installed below grade. See duct banks.

3. BRANCH CIRCUITS, SIGNAL AND CONTROL CIRCUITS, AND INDIVIDUAL EQUIPMENT CIRCUITS RATED LESS THAN 100 AMPS:
 - a. Install in electric metallic tubing (EMT); except in poured walls, with one side in contact with grade, below concrete slab-on-grade or in earth fill, install in non-metallic plastic duct. In areas exposed to weather, moisture, or physical damage, install in GRC or IMC. In suspended slabs, install in EMT. Encase non-metallic duct 1-1/4" and larger in concrete. See duct banks.
- B. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.
- C. Install raceway in accordance with the following:
 1. Provide a minimum of 12" clearance measured from outside of insulation from flues, steam and hot water piping, etc. Avoid installing raceways in immediate vicinity of boilers and similar heat emitting equipment. Conceal raceways in finished walls, ceilings and floor (other than slab-on-grade), except in mechanical, electrical and/or communication rooms, conceal all conduit and connections to motors, equipment, and surface mounted cabinets unless exposed work is indicated on the drawings. Run concealed conduits in as direct a line as possible with gradual bends. Where conduit is exposed in mechanical spaces, etc., install parallel with or at right angles to building or room structural lines. Do not install lighting raceway until piping and duct work locations have been determined in order to avoid fixtures being obstructed by overhead equipment.
 2. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway. Paint all field threads (or portions of raceway where corrosion protection has been damaged) with primer and enamel finish coat to match adjacent raceway surface.
- D. Comply with NEC for requirements for installation of pull boxes in long runs.
- E. Cap open ends of conduits and protect other raceways as required against accumulation of dirt and debris. Pull a mandril and swab through all conduit before installing conductors. Install a 200 lb. nylon pull cord in each empty conduit run.
- F. Replace all crushed, wrinkled or deformed raceway before installing conductors.
- G. Do not use flame type devices as a heat application to bend PVC conduit. Use a heating device which supplies uniform heat over the entire area without scorching the conduit.
- H. Provide rigid metal conduit (RMC) for all bends greater than 22 degrees in buried conduit. Provide protective coating for RMC bend as specified herein.
- I. Where raceways penetrate building, area ways, manholes or vault walls and

floors below grade, install rigid metal conduit (RMC) for a minimum distance of 10 feet on the exterior side of the floor or wall. Provide OZ, Type FSK, WSK or CSMI sealing bushings (with external membrane clamps as applicable) for all conduit penetrations entering walls or slabs below grade. Provide segmented type CSB internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway.

- J. Install liquid-tight flexible conduit for connection of motors, transformers, and other electrical equipment where subject to movement and vibration.
- K. Provide OZ expansion fittings on all conduits crossing building expansion joints, both in slab and suspended.
- L. Complete installation of electrical raceways before starting installation of cables/conductors within raceways.
- M. Raceway installation below grade:
 - 1. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.
 - 2. Mark all buried conduits which do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
 - 3. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.
- N. Raceway installation below slab-on-grade, or below grade:
 - 1. For slab-on-grade construction, install runs of rigid plastic conduit (PVC) below slab. All raceway shall be located a minimum of 4" below gravel sub-base. Install RMC (with protective coating) for raceways passing vertically through slab-on-grade. Slope raceways as required to drain away from electrical enclosures and to avoid collection of moisture in raceway low points.
 - 2. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.
 - 3. Mark all buried conduits which do not require concrete encasement by

placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.

4. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.

O. DUCTBANKS:

1. Provide ductbank construction as indicated using 3000 psi at 28 day strength concrete, with red marker dye. Use Type II low alkali per ASTM C150. Use ASTM C-33 aggregate gradation with maximum size of 3/4". Use W/C ratio of 0.50. Install #4 reinforcing bar per ASTM 615 grade 50 in each corner of ductbank. Provide minimum 4" concrete cover on all sides of exterior conduits. Provide polypropylene pull rope in all spare duct.

END OF SECTION 16110

SECTION 16120 - CONDUCTORS AND CABLES (600V AND BELOW)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to conductors and cables specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical conductor and electrical cable work is indicated by drawings and schedules.
- B. Types of conductors and cables in this section include the following:
 - 1. [Copper Conductors (600V)]
- C. Applications for conductors and cables required for project include:
 - 1. Power Distribution
 - 2. Feeders
 - 3. Branch Circuits

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to construction and installation of electrical conductors and cable. Comply with UL standards and provide electrical conductors and cables which have been UL-listed and labeled.
- B. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of conductors and cable.
- C. Comply with applicable portions of ANSI/ASTM and IEEE standards pertaining to construction of conductors and cable.

1.4 SUBMITTALS:

- A. FIELD TEST DATA:
 - 1. Submit megohmmeter test data for circuits under 600 volts.

PART 2 - PRODUCTS

2.1 COPPER CONDUCTORS (600V):

- A. Provide factory-fabricated conductors of sizes, ratings, materials, and types indicated for each service. Where not indicated provide proper selection to comply with project's installation requirements and NEC standards. Provide conductors in accordance with the following:
 - 1. Service Entrance Conductors – Copper conductor; see drawings for insulation type.
 - 2. Distribution and Panelboard Feeders; and Other Conductors, #2 AWG and Larger – Copper conductor; see drawings for insulation type.
 - 3. Branch Circuit Conductors and All Conductors #3 AWG and Smaller - Copper conductor, with THHN/THWN insulation. Size all conductors in accordance with NEC; minimum size to be #12 AWG. Provide stranded conductors for #8 AWG and larger.
- B. Provide color and coding of conductors as follows:

120/208V

A-Phase - Black

B-Phase - Red

C-Phase - Blue

Neutral - White

Ground - Green
- C. Provide colors for switch legs, travelers and other wiring for branch circuits different than listed above.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Install electric conductors and cables as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in accordance with recognized industry practices.
- B. Coordinate installation work with electrical raceway and equipment installation work, as necessary for proper interface.
- C. Cables may be pulled by direct attachment to conductors or by use of basket weave pulling grip applied over cables. Attachment to pulling device shall be made through approved swivel connection. Nonmetallic jacketed cables of small

size may be pulled directly by conductors by forming them into a loop to which pull wire can be attached; remove insulation from conductors before forming the loop. Larger sizes of cable may be pulled by using basket weave pulling grip, provided the pulling force does not exceed limits recommended by manufacturer; if pulling more than one cable, bind them together with friction tape before applying the grip. For long pulls requiring heavy pulling force, use pulling eyes attached to conductors.

- D. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-section area.
- E. Pull in cable from the end having the sharpest bend; i.e. bend shall be closest to reel. Keep pulling tension to minimum by liberal use of lubricant, and turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one in pullhole during this operation.
- F. For training of cables, minimum bend radius to inner surface of cable shall be 12 times cable diameter.
- G. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50% greater than specified above for training.
- H. Use only wire and cable pulling compound recommended by the specific cable manufacturer, and which is listed by UL.
- I. Seal all cable ends unless splicing is to be done immediately. Conduit bodies shall not contain splices.
- J. Support all cables in pullholes, concrete trenches, and similar locations by cable racks and secure to rack insulators with nylon cord or self-locking nylon cable ties. Place each cable on separate insulator. In manholes, pullholes, concrete trenches, and similar locations, wrap strips of fire-proofing tape (approx. 1/16 inch thick by 3 inches wide) tightly around each cable spirally in half-lapped wrapping or in two butt-joined wrappings with the second wrapping covering the joints in the first. Apply tape with the coated side toward the cable, and extend tape one inch into the ducts. To prevent unraveling, random wrap the fireproofing tape the entire length of the fireproofing with pressure sensitive glass cloth tape. Provide fireproofing tape of a flexible, conformable fabric having one side coated with flame retardant, flexible, polymeric coating and/or a chlorinated elastomer not less than 0.050 inch thick weighing not less than 2.5 pounds per square yard. Provide tape which is noncorrosive to cable sheath, self-extinguishing, and which will not support combustion. Construct tape of materials which do not deteriorate when subjected to oil, water, gases, salt water, sewage and fungus.
- K. Follow manufacturer's instructions for splicing and cable terminations.

3.2 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW:

- A. Prior to energization, test cable and wire for continuity of circuitry, and for short circuits, Megger all circuits of 100 amp and greater rating. Correct malfunctions. Submit record in triplicate of megohmmeter readings to Architect/Engineer.
- B. Subsequent to wire and cable connections, energize circuitry and demonstrate functioning in accordance with requirements.
- C. IDENTIFICATION OF FEEDERS: Each cable at each entry to and exit for each manhole, pullhole, pullbox, cable tray switchgear and switch, shall have a marker affixed, upon which is stamped or embossed the feeder designation; i.e. "MCCI", "PANEL L", "CHILLER", "NO. 1", etc. Identification letters shall be 1/8 inch minimum size. Markers shall be rigid, non-corrosive material, attached to the feeder cables with feeder identification. Nylon straps shall be used to tie the markers.

END OF SECTION 16120

SECTION 16135 - ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is a part of each Division-16 section making reference to electrical wiring boxes and fittings specified herein. See Section 16110, Raceways, for additional requirements.

1.2 DESCRIPTION OF WORK:

- A. The extent of electrical box and electrical fitting work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings in this section include the following:
 - 1. Outlet Boxes
 - 2. Junction Boxes
 - 3. Pull Boxes
 - 4. Conduit Bodies
 - 5. Bushings
 - 6. Locknuts
 - 7. Knockout Closures
 - 8. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to construction and installation of electrical boxes and fittings. Comply with ANSI C 134,1 (NEMA Standards Pub No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports. Provide electrical boxes and fittings which have been UL-listed and labeled.

1.4 SUBMITTALS: None required

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

- A. INTERIOR OUTLET BOXES:
 - 1. Provide one piece, galvanized flat rolled sheet steel interior outlet wiring boxes with accessory rings, of types, shapes and sizes, including box depths, to suit each respective location and installation, construct with stamped knockouts in back and sides, and with threaded screw holes

with corrosion-resistant screws for securing box and covers and wiring devices; minimum size 4"x4"x1-1/2". Provide minimum 2-1/8" depth for boxes with three or more conduit entries.

2. Provide an 'FS' box, with no knockouts when surface mounted in a finished, non-utility space. Surface mounting is only acceptable when approved by the Architect.

B. INTERIOR OUTLET BOX ACCESSORIES:

1. Provide outlet box accessories as required for each installation, including mounting brackets, hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring applications.

C. WEATHERPROOF OUTLET BOXES:

1. Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes (including depth) required, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, with face plate gaskets and corrosion-resistant fasteners.

D. JUNCTION AND PULL BOXES:

1. Provide code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

E. CONDUIT BODIES:

1. Provide galvanized cast-metal conduit bodies, of types, shapes and sizes to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

F. BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS:

1. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and malleable steel conduit bushings and offset connectors, of types and sizes to suit respective uses and installation.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. GENERAL:

1. Install electrical boxes and fittings where indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
2. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.
3. Provide coverplates for all boxes.
4. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.
5. Provide knockout closures to cap unused knockout holes where blanks have been removed.
6. Install boxes and conduit bodies to ensure ready accessibility of electrical wiring. Do not install boxes above ducts or behind equipment. Install recessed boxes with face of box or ring flush with adjacent surface. Seal between switch, receptacle and other outlet box openings and adjacent surfaces with plaster, grout, or similar suitable material.
7. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10" of conduit between them.
8. Provide electrical connections for installed boxes.

END OF SECTION 16135

SECTION 16136 - SUPPORTING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification section, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is a part of each Division-16 section making reference to supports, anchors, sleeves, and seals, specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of supports, anchors, and sleeves is indicated by drawings and schedules and/or specified in other Division-16 sections. See Section 16110, Raceways, for additional requirements.
- B. Work of this section includes supports, anchors, sleeves and seals required for a complete raceway support system, including but not limited to: clevis hangers, riser clamps, C-clamps, beam clamps, one and two hole conduit straps, offset conduit clamps, expansion anchors, toggle bolts, threaded rods, U-channel strut systems, threaded rods and all associated accessories.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to construction and installation of electrical supporting devices. Comply with applicable requirements of ANSI/NEMA Std. Pub No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies". Provide electrical components which are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

- A. GENERAL:
 - 1. Provide supporting devices; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified. See drawings for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

- A. Install hangers, anchors, sleeves, and seals as required, in accordance with manufacturer's written instructions and with recognized industry practices to

insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports, clamps and attachments to support piping properly from building structures. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. For pre-and post tensioned construction, use pre-set inserts for support of all electrical work. Do not use toggle bolts, moly bolts, wood plugs or screws in sheetrock or plaster as support for any equipment or raceway.
- D. RACEWAYS:

1. Support raceways which are rigidly attached to structure at intervals not to exceed 8 feet on center, minimum of two straps per 10 foot length of raceway, and within 12" of each junction box, coupling, outlet or fitting. Support raceway at each 90 degree bend. Support raceway (as it is installed) in accordance with the following:

| <u>NUMBER OF RUNS</u> | <u>3/4" TO 1-1/4" Ø</u> | <u>1-1/2" & LARGER Ø</u> |
|-----------------------|---------------------------------|------------------------------|
| 1 | Full straps, clamps or hangers. | Hanger |
| 2 | Full straps, clamps or hangers. | Mounting Channel |
| 3 or more | Mounting Channel | Mounting Channel |

2. Support suspended raceways on trapeze hanger systems; or individually by means of threaded rod and straps, clamps, or hangers suitable for the application. Do not use "tie wire" as a portion of any raceway support system; do not support raceway from ceiling support wires.

E. FLOOR MOUNTED EQUIPMENT:

1. Provide rigid attachment of all floor mounted equipment to the floor slab or structural system. Provide 5/8" bolts or expansion anchors at each 90 degree corner and at intervals not to exceed 48" on center along entire perimeter of the equipment. Provide rigid attachment for all floor mounted switchboards, panelboards, power and control equipment, motor control centers, dimmer cabinets, transformers (provide neoprene vibrations isolators at anchor points), oil switches, battery packs and racks, and similar equipment furnished under Section 16.

F. WIREWAYS, BUS DUCTS AND CABLE TRAYS:

1. Provide vertical and lateral support systems for all wireways, busway, and

cable trays which are supported from overhead structure. See Sections 16111 and 16145 for additional requirements.

END OF SECTION 16136

SECTION 16155 - MOTOR STARTERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of Division-16 sections making reference to motor starters specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of motor starter work is indicated by drawings and schedules.
- B. Types of motor starters in this section include the following:
 - 1. AC Fraction Horsepower Manual Starters
 - 2. AC Combination Non-Reversing Magnetic Starters

1.3 QUALITY ASSURANCE:

- A. Comply with NEC and NEMA Standards as applicable to wiring methods, construction and installation of motor starters. Comply with applicable requirements of UL 508, "Electric Industrial Control Equipment", pertaining to electrical motor starters. Provide units which have been UL-listed and labeled.

1.4 SUBMITTALS:

- A. PRODUCT DATA: Submit manufacturer's data on motor starters.
- B. SHOP DRAWINGS: Submit dimensioned drawings of motor starters showing accurately scaled equipment layouts.
- C. MOTOR VOLTAGE/CURRENT REPORT: After installation is complete, including water and air balancing, measure voltage (L-L and L-N) and full load current of each phase of each motor. Submit report showing field readings of voltage, amperage, service factor, and thermal heater size installed for each motor.

PART 2 - PRODUCTS

- A. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type and rating of motor starter):
 - 1. Eaton Corp., Cutler Hammer Products
 - 2. General Electric Co.
 - 3. Siemens Energy and Automation

4. Square D Co.

- B. MAINTENANCE STOCK, FUSES: For types and ratings required, furnish additional fuses, amounting to one unit for every 10 installed units, but not less than 5 units of each, for both power and control circuit fuses.

2.2 MOTOR STARTERS:

- A. GENERAL: Except as otherwise indicated, provide motor starters and ancillary components; of types, sizes, ratings and electrical characteristics indicated which comply with manufacturer's standard materials, design and construction in accordance with published information and as required for complete installations.
- B. THERMAL OVERLOAD UNITS: Provide thermal overload units, sized to actual running full load current, not to motor plate current. Size heaters for mechanical equipment after air and water balancing have been completed.
- C. AC FRACTIONAL HP MANUAL STARTERS (EQUAL TO SQUARE D CLASS 2510): Provide manual, single-phase, 1 and 2 pole, 300 volt AC max, fractional HP motor starters, of types, ratings and electrical characteristics indicated; equip with one piece thermal overload relay with field adjustment capability of plus or minus 10 percent of nominal overload heater rating; for protection of AC motors of 1 HP and less. (For manually controlled motors in excess of 1 HP, see Line Voltage Manual Starters specified herein). Provide starter with quick-make, quick-break trip free toggle mechanisms, green pilot lights, and with lock-off toggle operated handle. Mount surface units in NEMA 1 enclosures, unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location unless noted otherwise. Provide flush mounted units with coverplate to match wiring device coverplates.
- D. AC COMBINATION NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8539): Provide line voltage combination starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volts max with non-reversing magnetic starters as specified herein; in common cubicle or enclosure with motor circuit protector. Provide motor circuit protector, instantaneous trip circuit breaker as indicated and adjust to comply with manufacturer's recommendations. Provide combination starters for individual mounting, or for group mounting in motor control center as indicated. Provide NEMA 3R enclosure in exterior or damp locations, unless noted otherwise. Provide NEMA 1 enclosures unless otherwise indicated.
- E. AC COMBINATION NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8538): Provide line voltage combination starters, of types, ratings, and electrical characteristics; 2 or 3 pole, 600 volt maximum with non-reversing magnetic starters as specified herein; in common cubicle or enclosure with fusible disconnect switch. Provide quick-make, quick-break, disconnect for NEMA sizes 1, 2, 3, and 4; and visible blade, automatic circuit interrupters with push-to-trip feature and separate fuse clips for larger NEMA sizes. Fuse all starters with dual-element (time-delay) fuses equal to Bussman FRN/FRS-R. Equip disconnect switch with Class R rejection fuse kits. Provide combination

starters for individual mounting, or for group mounting in motor control centers as indicated. Provide NEMA 1 enclosures unless otherwise indicated. Provide NEMA 3R enclosure in exterior or damp locations, unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR STARTERS:

- A. Install motor starters as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Install fuses in fusible disconnects, if any. Mount chart inside each starter indicating heater type, size, and ampere ratings available.
- C. IDENTIFICATION: Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each starter cabinet. Provide red plastic laminate label for starters supplied by emergency power. Include mechanical equipment designation, horsepower and voltage.

3.2 ADJUST AND CLEAN:

- A. Inspect operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finish.

3.3 FIELD QUALITY CONTROL:

- A. Subsequent to wire/cable hook-up, energize motor starters and demonstrate functioning of equipment in accordance with requirements.

END OF SECTION 16155

SECTION 16170 - MOTOR AND CIRCUIT DISCONNECTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to motor and circuit disconnect switches specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of motor and circuit disconnect switch work is indicated by drawings and schedule. Work includes complete installations and electrical connections.

1.3 QUALITY ASSURANCE:

- A. Provide motor and circuit disconnect switches which have been UL listed and labeled. Comply with applicable requirements of NEMA Standards Pub. No. KS 1, and NEC.

1.4 SUBMITTALS:

- A. **PRODUCT DATA:** Submit manufacturer's data including specifications, installation and general recommendations, for each type of motor and circuit disconnect switch required.
- B. **SHOP DRAWINGS:** Submit dimensioned drawings of electrical motor and circuit disconnect switches which have rating of 100 amperes and larger.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. **MANUFACTURER:** Subject to compliance with requirements, provide products of one of the following (for each type of switch):
 - 1. Cutler Hammer Products, Eaton Corp.
 - 2. Siemens Energy and Automation
 - 3. Square D Company
 - 4. General Electric Company

2.2 FABRICATED SWITCHES:

- A. **GENERAL:** Provide disconnect and safety switches as indicated herein. Provide:

1. General duty switches on 240 Volt rated circuits.
 2. HP rated switches on all motor circuits.
- B. GENERAL DUTY SWITCHES: Provide general-duty type, sheet-steel enclosed switches, fusible or non-fusible as indicated of types, sizes and electrical characteristics indicated; rated 240 volts, 60 hertz; incorporating spring assisted, quick-make, quick-break mechanisms. Provide single phase or three phase and with solid neutral as required by application. Equip with operating handle which is capable of being padlocked in OFF position. Provide NEMA 1 or NEMA 3R as required by application, unless noted. Provide fusible switches with Class R rejection fuse clip kits.
- C. FUSES: Provide fuses for switches, as required of classes, types and ratings needed to fulfill electrical requirements for service indicated. Provide spare fuses amounting to one spare fuse for each 10 installed but not less than three of any one type and size. See Section 16180 Overcurrent Protective Devices for fuse types.
- D. IDENTIFICATION: Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each disconnect. Provide red plastic laminate labels on disconnects supplied with emergency power.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES:

- A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. Coordinate motor and circuit disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.
- C. Install disconnect switches used with motor driven appliances, and motors and controllers within sight of controller position.

END OF SECTION 16170

SECTION 16180 - OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to overcurrent protective devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of overcurrent protective device work is indicated by drawings and schedules and specified herein. Overcurrent protective devices specified herein are for installation as individual components in separate enclosures; and for installation as integral components of switchboard and panelboards. See Section 16175, Switchgear and Switchboards, and Section 16160, Panelboards.
- B. Types of overcurrent protective devices in this section include the following for operation at 600 Volts and below:
 - 1. Molded case circuit breakers
 - 2. Fusible switches
 - 3. Fuses
- C. Refer to other Division-16 sections for cable/wire and connector work required in conjunction with overcurrent protective devices.

1.3 QUALITY ASSURANCE

- A. Comply with NEC requirements and NEMA and ANSI standards as applicable to construction and installation of overcurrent devices.

1.4 SUBMITTALS:

- A. **PRODUCT DATA:** Submit manufacturer's data on overcurrent protective devices, including catalog cuts, time-current trip characteristic curves, and mounting requirements.
- B. **SHOP DRAWINGS:** Submit layout drawings of overcurrent protective devices, with layouts of circuit breakers, including spatial relationships to proximate equipment. Failure to submit said spatial layouts does not relieve contractor of responsibility to verify all required clearances before release of equipment for fabrication.
- C. **MAINTENANCE STOCK, FUSES:** For types and ratings required, furnish

additional fuses, amounting to one unit for every 5 installed units, but not less than two units of each size and type, unless specified otherwise in another section of these specifications.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide products of one of the following (main and branch device manufacturer must be same as panelboard and/or switchboard manufacturer):
- B. CIRCUIT BREAKERS AND FUSIBLE SWITCHES:
 - 1. Cutler Hammer Products, Eaton Corp.
 - 2. General Electric Co.
 - 3. Siemens Energy and Automation
 - 4. Square D Co.
- C. MOLDED CASE CIRCUIT BREAKERS:
 - 1. Provide factory-assembled, molded case circuit breaker for power distribution panelboards and switchboards; and for individual mounting, as indicated. Provide breakers of amperage, voltage, and RMS interrupting rating shown, with permanent thermal trip and adjustable instantaneous magnetic trip in each pole. Series rated systems are not acceptable. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 degrees C. Provide with mechanical screw type removable connector lugs, AL/CU rated, of proper size to accommodate conductors specified.
- D. FUSIBLE SWITCHES:
 - 1. Provide factory-assembled fusible switch units for power distribution panelboards and switchboards, and individual mounting as indicated. Provide switch units of amperage, voltage, and RMS interrupting rating as shown, with quick-make, quick-break mechanisms, visible blades and dual horsepower ratings. Series rated systems are not acceptable. Equip with lockable handles with on-off indication. Interlock switch covers and handles to prevent opening in "ON" position. Provide switch with Class R rejection fuse clip kits. Provide AL/CU rated lugs of proper size to accommodate conductors specified.

2.2 FUSES

- A. GENERAL: Except as otherwise indicated, provided fuses of type, sizes and ratings and electrical characteristics of a single manufacturer as follows. Provide fuses labeled UL Class L or UL Class R, current limiting and rated for up to

200,000 amperes. Provide Buss KAZ signal activating fuses where required elsewhere in specification.

- B. Where fuses are shown feeding individual or groups of equipment items, comply with manufacturer's recommendation for fusing; adjust fuse size and type as necessary to comply with manufacturer's recommendation.
- C. Provide and install spare fuse cabinet in main electrical room.
- D. MAIN SERVICE AND FEEDER CIRCUITS: For fuse ratings over 600 amperes provide UL Class L Fuses (KRP-C, or A4BQ or LCL or KLPC). For fuse ratings up to 600 amperes, provide UL Class RK1 (KTN-R, KTS-R or A2K-R, A6K-R or NCCR, SCLR or KLN-R, KLS-R). If fuse directly feeds motors, transformers or other inductive load provide UL RK5 time delay (FRN-R, FRS-R or TR-R, TRS-R or ECN-R, ECS-R or FLN-R, FLS-R).
- E. BRANCH CIRCUITS: For motor circuits, transformer circuits, or other inductive loads, provide UL Class RK5 (FRN-R, FRS-R or TR-R, TRS-R or ECN-R, ECN-S or FLN-R, FLS-A). For other circuits, provide UL Class RK1, (KTN-R, KTS-R OR A2K-R, A6K-R or NCLR, SCLR OR KLN-R, KLSR).
- F. MANUFACTURER: Subject to compliance with requirements, provide fuses of one of the following:
 - 1. Bussman Mfg. Co.
 - 2. Gould Shawmut, Gould Electric Fuse Division
 - 3. Reliance Fuse Div./Brush Fuse Inc.
 - 4. Littlefuse, Inc.
- G. IDENTIFICATION: Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of all overcurrent devices which are furnished in separately mounted enclosures. Provide red labels for devices supplied with emergency power.

PART 3 – EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES:

- A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.
- B. Coordinate with work as necessary to interface installations of overcurrent protective devices with other work.
- C. Where a neutral is supplied for equipment of gasoline pumps, install a disconnect/breaker to switch the neutral with the phase conductors when disconnect is opened.

- D. Install fuses in overcurrent protective devices. For motor circuits, fuse sizes shown on drawings are for general guidance only. Size fuses in accordance with fuse manufacturer's recommendation for given motor nameplate ampere rating. Test operation. If nuisance tripping occurs, increase fuse size and disconnect device (if necessary) as required to provide nuisance free tripping. Adjust fuse size properly for ambient temperature, frequent starting and stopping of motor loads, and for loads with long start times. Include all costs in bid.
- E. Field test all ground fault protective devices for proper operation; test to be performed by representative of the manufacturer. Include verification of complete time current trip characteristics.

3.2 FIELD QUALITY CONTROL

- A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 16180

SECTION 16452 - GROUNDING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Provide grounding as specified herein, and as indicated on drawings.
- B. Provide grounding and bonding of all electrical and communication apparatus, machinery, appliances, building components, and items required by the NEC to provide a permanent, continuous, low impedance, grounding system.
- C. Unless otherwise indicated, ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, and equipment in accordance with all code requirements.
- D. Ground each separately derived system, as described in NEC Section 250-30, unless otherwise indicated.
- E. Types of grounding in this section include the following:
 - 1. Service Equipment
 - 2. Enclosures
 - 3. Equipment
 - 4. Other items indicated on drawings
- F. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to electrical grounding and ground fault protection systems. Comply with applicable ANSI and IEEE requirements. Provide products which have been UL listed and labeled.
- B. Resistance from the service entrance ground bus, through the grounding electrode to earth, shall not exceed 5 ohms.

1.4 SUBMITTALS:

- A. Submit the name of test agency to be used for testing specified in this section.

Submit results of tests specified in this section. Also include test results in Operation and Maintenance Manuals as specified.

PART 2 – PRODUCTS

2.1 MATERIALS AND COMPONENTS:

- A. GENERAL: Except as otherwise indicated, provide each electrical grounding system as specified herein, and as shown on drawings, including but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.
- B. INSULATED GROUNDING BUSHINGS: Plated malleable iron body with 150 degree Centigrade molded plastic insulating throat, lay-in grounding lug with hardened stainless steel fasteners, OZ/Gedney BLG, or Thomas & Betts #TIGB series.

PART 3 - EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS:

- A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding devices comply with requirements.
- B. Install clamp-on connectors only on thoroughly cleaned and metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- C. Provide grounding for the entire raceway, enclosure, equipment and device system in accordance with NEC. All non-metallic raceways shall include copper grounding conductor sized in accordance with NEC. Include copper grounding conductor in all raceway installed in suspended slabs.

3.2 GROUNDING ELECTRODES:

- A. EQUIPMENT BONDING/GROUNDING: Provide a NEC sized conductor, whether indicated or not on the drawings, in raceways as follows:
 - 1. Non-metallic conduits and ducts.
 - 2. Distribution feeders.
 - 3. Motor and equipment branch circuits.
 - 4. Device and lighting branch circuits.
 - 5. Provide grounding bushings and bonding jumpers for all conduit terminating in reducing washers, concentric, eccentric or oversized knockouts at panelboards, cabinets and gutters.
- B. Provide bonding wire in all flexible conduit.

END OF SECTION 16452

SECTION 16610 - EMERGENCY ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of emergency electrical system work is indicated by drawings and schedules.
- B. Types of emergency system components specified in this section include the following:
 - 1. Automatic Transfer Switches (ATS)
 - 2. By-pass/Isolation Switches (BP/IS)
 - 3. Emergency Generators (Diesel)
 - 4. Day Tanks
 - 5. Exhaust and Fuel Systems
 - 6. Remote Annunciator Panels
- C. CONDUCTORS/CABLES, RACEWAYS, AND ELECTRICAL BOXES AND FITTINGS are specified in applicable Division-16 Basic Materials and Methods sections.
- D. Refer to other Division-16 sections as applicable for work required in connection with emergency electrical systems.
- E. Refer to Division-15 sections for fuel tanks, piping and accessories required in conjunction with engine-generator units; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to wiring methods, materials, construction and installation of emergency electrical systems. Comply with applicable requirements of UL 924, "Emergency Lighting and Power Equipment" and UL 1008, "Automatic Transfer Switches". Provide system components, which are UL-listed and labeled.
- B. Comply with applicable requirements of NFPA Nos. 37, (99), 101, and 110 pertaining to stationary combustion engines, (health care facilities), life safety code, and emergency and standby power supplies.

- C. Comply with ANSI/NEMA Std. Pub. No. ICS 2, pertaining to AC automatic transfer switches. Comply with applicable requirements of ANSI/NEMA MG 1, "Motors and Generators", and MG 2, "Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators". Comply with applicable portions of IEEE Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to standby power.

1.4 SUBMITTALS:

- A. SHOP DRAWINGS: Submit the following:
 - 1. Dimensioned drawings of emergency electrical system components and accessories including, but not necessarily limited to generator sets, isolation/by-pass switches, day tanks, transfer switches, instruments and accessories, (and) annunciator panels, (and fuel line and exhaust piping). Show accurately scaled layouts of system components; indicate their spatial relationship to associated equipment; show connections to normal and emergency power feeders. Failure to submit said scaled lay-outs does not relieve contractor of responsibility to verify all required clearances before release of equipment for fabrication.
 - 2. Manufacturer's standard catalog data describing and depicting each engine-generator set, batteries, charger, tanks, and all ancillary equipment in sufficient detail to demonstrate complete specification compliance.
 - 3. Drawings depicting each of the following:
 - a. Base mounted equipment, with base and all attachments including anchor bolt template and recommended clearances for maintenance and operation.
 - b. Complete starting system, fuel system, cooling system, and exhaust system.
 - c. Electric wiring of relays, breakers, and switches with applicable single line and wiring diagrams and written description of operation and the instrumentation provided.
 - d. Enclosure (if applicable).
- B. Manufacturer's standard catalog data describing and depicting each transfer and by-pass isolation switch along with all ancillary equipment in sufficient detail to demonstrate complete specification compliance. In addition provide the following:
 - 1. One-line diagram of each switch assembly and wiring diagram of each unit.
 - 2. A complete list of equipment and material to be provided, containing an adequate description of each separate item of equipment.

- C. **OPERATION AND MAINTENANCE MANUALS:** Submit four complete sets of operating manuals for each item of equipment and/or component outlining the step-by-step procedure required for system start up, operation, and shutdown. Include the manufacturer's name, model number, and a description of all equipment, complete with basic operating features. Describe in detail all maintenance procedures and a troubleshooting guide listing possible breakdowns and repairs for each piece of equipment. Include all factory service manuals, complete parts lists, simplified schematic diagrams of each system as installed, and the originals from which all posted instructions were made. Include complete test reports specified in Part 3-Execution herein.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Provide emergency electrical systems and components, of types, ratings, and electrical characteristics indicated. Provide all system components thru one supplier to guarantee total system responsibility. Provide system and components capable of start and load transfer within 10 seconds of power outage.

2.2 ENVIRONMENTAL CONDITIONS:

- A. Provide system components and accessories as required to ensure proper system operation at rated capacities under the following environmental conditions:
1. Altitude: 5000 feet above sea level
 2. Maximum ambient temperature: 50 degrees C.
 3. Minimum ambient temperature: 0 degrees C.
 4. Seismic Zone 3

2.3 AUTOMATIC TRANSFER SWITCHES:

- A. Provide contactor type service entrance rated automatic transfer switches compatible with electric sets, and of continuous ampere rating sufficient to meet requirements of both maximum set output and normal power service. Switches which employ interlocking handles and circuit breakers to affect transfer are not acceptable. Provide 4 pole switches where distribution system is provided with ground fault protective relaying, or where indicated on drawings. Provide switches of voltage and phase indicated, and with the following features and characteristics:
1. Provide precision calibrated voltage sensors to monitor the normal power source and signal the electric set to start on a partial loss of power on any phase or where feedback voltages exist. Provide adjustability to signal start-up when line voltage drops 5 percent to 20 percent below pick-up voltage setting, and to signal shutdown when line voltage returns to 75% to 100% of normal.

2. Provide a time delay relay, adjustable from 1 to 10 seconds, to delay the signal to start to avoid nuisance start ups on momentary voltage dips or power outages.
 3. Provide voltage sensors to sense return of normal power; and a time delay, adjustable 2 to 60 minutes, to delay the retransfer of load to normal to avoid short term fluctuations in normal power restoration.
 4. Provide an engine cool-down timer, adjustable from 0 to 5 minutes, for unloaded engine cool-down time. Timer shall engage after retransfer to normal.
 5. Provide pilot light to indicate switch in normal position and pilot light to indicate switch in emergency position. Mount pilot lights in front face of enclosure.
 6. Obtain operating current for transfer and retransfer from the source to which the load is to be transferred. Provide automatic bypass to retransfer the load from the electric set to the normal source if the electrical set output interrupts after normal source restores voltage.
 7. Provide switch to simulate an interruption of power from the normal source.
 8. Provide manual operator with removable handle for manual operation of the switch.
 9. Provide clock exerciser to automatically start the electrical set at regular intervals and allow it to run for a preset time period; minimum of 30 minutes per week. Equip with selector switch to permit selection of "without load" or "with load" operation.
 10. Provide means to electrically disconnect the control section from the transfer switch for maintenance service during normal operation.
 11. Provide battery charger mounted inside transfer switch enclosure.
 12. Provide time delay neutral position transfer in both directions to allow transfer switch to be disconnected from both sources during transfer from one source to another. Time delay shall be adjustable from 0 to 2 seconds.]
 13. Provide ammeter with 4-position selector switch marked "Off", "1", "2", and "3" to read current in all three phases of the load circuit.
- B. RATING AND PERFORMANCE: Rate automatic transfer switch for continuous duty when enclosed in a non-ventilated NEMA 1 enclosure. Rate switch for all classes of load, both inductive and non-inductive, at 600 volts; and tungsten lamp load at 205 volts.
- C. Switch must be capable of closing into and withstanding fault current of 65,000 amperes RMS symmetrical at 600 volts, 0.12 power factor without the protection of fuses or other current limiting devices.
- D. CONSTRUCTION: Provide operating mechanism with sufficient mechanical and electrical interlocks to prevent simultaneous energizing both normal and standby service. Provide main contacts with arc suppression and heat dissipation devices to provide dependable transfer of highly inductive loads. Equip switch with terminal lugs for either copper or aluminum conductor.
- E. ENCLOSURE: Enclose switch in heavy gauge, welded seam construction,

NEMA 1 enclosure.

- F. MANUFACTURERS: Subject to compliance with requirements, provide automatic transfer switches of one of the following:
1. Caterpillar Tractor Co
 2. Onan Corp.
 3. Kohler Power System

2.4 BY-PASS/ISOLATION SWITCHES:

- A. Provide each by-pass isolation switch in the same enclosure as the associated transfer switch, complete with all interconnecting wiring for power and control. Provide separate compartments for the BP/IS and ATS switches with barriers between the component switches. Construct the switch to permit load by-pass to either the normal or the emergency source of power and to allow complete isolation of the associated ATS, independent of the operating position of the ATS. BP/IS shall not have overload or fault current protective devices. The BP/IS and the associated ATS shall be the products of the same manufacturer and shall be completely interconnected, and tested at the factory. Provide BP/IS of equal or greater comparable electrical ratings than specified for the associated ATS.
- B. Switch design and construction shall prevent stops in an intermediate or neutral position during operations, but shall permit load by-pass and transfer switch isolation in no more than two manual operations which can be performed by one person in 5 seconds or less. Operation of the BP/IS shall be assured regardless of the position of the ATS. Provide indicating lights to show the BP/IS in the by-pass position, and in the fully isolated position.
- C. The switch shall be fully manually operated and shall not be dependent upon electrical operators, relays, or interlocks for operation. Provide main contacts and operating linkages identical to the ATS except that the operation shall be manual.
- D. Provide necessary controls to assure that the "engine run" circuit remains closed when the switch is in the bypass to emergency position, even though the associated transfer switch is in the "normal" position or completely removed from the enclosure.
- E. The BP/IS switch shall have the same number of poles (3 or 4) as specified for the associated ATS.
- F. Provide a solenoid interlock to prevent the operator from switching the BP/IS switch to a dead source of power.
- G. MANUFACTURERS: Subject to compliance with requirements, provide automatic transfer switches of one of the following:
1. Caterpillar Tractor Co
 2. Onan Corp.

3. Kohler Power System

2.5 ENGINE GENERATOR UNITS:

- A. Provide 60 hertz alternating-current standby-diesel engine-driven generator units of voltage, phase and capacities indicated. Base rating of electric sets upon operation after deducting power required for output for all necessary operating accessories, (including remote or direct drive radiator fans, fuel pumps, etc.) and under environmental conditions specified. Provide electric sets rated and capable of producing KW specified at 0.8 power factor for continuous standby duty. Certify performance of the electric set series by means of independent testing laboratory tests for full power rating stability, and voltage and frequency regulation.
- B. Provide stationary, water cooled, full diesel, compression ignition, four stroke cycle, multi-cylinder, in-line or V-type engine. Arrange engine for direct connection to an alternator current generator; do not exceed engine speed of 1800 RPM at full rated load. Completely assemble engine, alternator, and components on a single base before shipping.
- C. LUBRICATION SYSTEM: Equip engine with a pressure lubricating system. Provide spin-on type full flow lubricating oil filters. Equip filter with bypass valve to insure oil circulation if filters are clogged. Include dipstick oil level indicator. Provide lube oil heater for engine generator units located outdoors or where ambient temperature requires lube oil heating.
- D. ENGINE COOLING SYSTEM: Provide engine cooling system which operates fully automatically while the engine is running. The cooling system coolant shall use a combination of water and ethylene-glycol sufficient for freeze protection at the minimum winter outdoor ambient temperature of the application. All coolant pumps shall be centrifugal type. Each engine shall have an engine-driven primary pump.
- E. The engine cooling radiator shall be:
 - 1. (Engine/skid mounted at the front of the mounting base. Provide coolant in accordance with manufacturer's recommendation.)
- F. Equip engine with thermostatically controlled water jacket heater on all water cooled units. On air-cooled engines provide an oil base heater. The heater voltage shall match available voltage at the site. Make all necessary connections of jacket and oil base heaters.
- G. AIR CLEANER: Provide reusable element air cleaner of size and type recommended by the engine manufacturer.
- H. STARTING: Equip engine with a 12 volt electric starting motor of sufficient capacity to crank the engine at a speed which will allow full diesel starting of the engine. Disengage starter automatically when engine starts.

- I. Provide engine start-stop switch with functions including reset, run/start, stop and automatic mode. Provide adjustable cycle cranking and cool down operation.
- J. Provide rack mounted lead-acid battery set mounted integrally with electric set base. Provide sufficient capacity for cranking the engine a minimum of 4 cranking periods with 2-minute intervals between cranks. Each cranking period shall have a maximum duration of 15 seconds. Provide capacity and voltage recommended by engine manufacturer. Equip with all necessary interconnecting cables. Provide suitable float type battery charger to maintain the batteries in charged condition.
- K. BATTERY CHARGER: Provide suitable automatic SCR voltage regulated battery charger with a maximum charge rate, as recommended by the manufacturer, to maintain batteries at full capacity during standby conditions. Equip with ammeter to indicate charge rate and protect circuit by either fuses or circuit breakers. Design charger such that it will not be damaged during engine cranking.
- L. ENGINE INSTRUMENTS: Provide a unit mounted console with the following items:
 - 1. Lubricating oil pressure gauge
 - 2. Lubricating oil temperature display
 - 3. Coolant fluid inlet/outlet temperature display
 - 4. Coolant temperature gauge
 - 5. Run time meter
 - 6. Fuel meter display
 - 7. Tachometer display
 - 8. Battery charge rate ammeter
 - 9. Engine Start-stop switch
- M. EXHAUST SYSTEM: Provide a critical type exhaust silencer, flexible exhaust connector, and all exhaust piping and insulation as required. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellow type. Expansion and flexible elements shall be stainless steel suitable for diesel-engine exhaust gas at 1000 degrees F.
- N. Comply with manufacturer's recommendations. Wrap the entire exhaust system, from manifold to roof or wall penetration with exhaust insulation blankets as manufactured by Advanced Thermal Products, Inc., Santa Ana, California. Install per manufacturer's instructions.
- O. ENGINE PROTECTION DEVICES: Provide the following engine protection devices with indicating light annunciation for each device:
 - 1. Low-oil pressure cut-out
 - 2. High air temperature cut-out
 - 3. Overspeed cut-out
 - 4. Low fuel
 - 5. Fuel overflow cut-out

- P. MOUNTING: Equip electric set with a suitable base for mounting on a level surface. Provide vibration isolators, rated for seismic zone specified herein, between the electric set and base.
- Q. FUEL: Provide engine capable of satisfactory performance on commercial grade diesel fuel as recommended by manufacturer.
- R. GOVERNOR: Equip engine with a high performance isochronous electronic governor to maintain frequency within the limits, as specified below by controlling engine and alternator speed.
 - 1. Stability: + or - 0.33 percent at rated load
 - 2. Speed Regulation: 5 percent maximum load to rated load
- S. The governor shall be configured for safe manual adjustment during operation of the engine-generator from 90 to 110 percent of rated frequency.

2.6 FUEL SYSTEM:

- A. Equip engine with primary and secondary fuel filters with replaceable elements, and an engine driven fuel pump, all mounted on the engine. Provide fuel system piping of size and type recommended by the engine manufacturer. Provide fuel tank(s) as follow(s):
 - 1. Provide diesel day tank of 300-gallon capacity, with positive displacement fuel pump control switch for maintaining supply of fuel in tank at predetermined levels and low fuel cut-off.

2.7 ELECTRIC ALTERNATOR:

- A. Provide direct connected, engine driven, single bearing, synchronous type alternator with electrical characteristics indicated.
- B. INSTANTANEOUS VOLTAGE DIP: Limit voltage dip of engine generator set to less than 30 percent upon application of full rated power. Accomplish voltage regulation by means of a solid state voltage regulator. Inherently regulated machines are acceptable in sizes under 6KW.
- C. Stability: 1 percent of its mean value at any constant load from no load to full load for solid state regulators.
- D. Regulation: Plus or minus 2 percent maximum no load to full load for solid state regulators.
- E. Where more than 40 percent of the load is comprised of rectifiers and/or thyristors, provide power to voltage regulator by means of ceramic type permanent magnet pilot excitor, capable of 80 percent automatic controlled SCR/Thyristor loading.

- F. Provide instrument panel and console with the following:
1. Manual reset circuit breaker
 2. A.C. voltmeter
 3. A.C. ammeter
 4. Voltmeter-ammeter phase selector switch with "off" position
 5. Frequency meter
 6. Start-Stop switch
 7. Remote start terminals
 8. Solid state cycle cranking control
 9. Engine safety alarm lights and contact
 10. Provide automatic solid state overload protection, under frequency protection, and volts/hertz characteristics.

2.8 WEATHERPROOF ENCLOSURE:

- A. Provide weatherproof enclosure for engine generator unit. Enclosure shall house all components including engine, alternator, batteries, battery charger, fuel tank and controls. Provide one piece roof with drip edge on all four sides and with formed roof stiffeners to support silencer. Provide angle iron frame around the entire bottom of the enclosure to attach to mounting surface. Provide doors on each side for access to engine, alternator and all components. Provide all doors with continuous piano type hinges with stainless steel pins. Provide lockable 2-point latches on all doors, keyed alike. Provide a welded fixed open air intake louver panel on each side to accomplish air intake. Provide a framed expanded metal core guard to accomplish air discharge. Assemble all components with plated bolts and nuts. Caulk all seams to prevent rust bleed through. Clean and paint all components with manufacturer's standard rust inhibiting primer. Provide finish coat paint color to match pad mounted transformer. All openings shall be provided with screen material to exclude entrance of rodents.]

2.9 SAFETY SYSTEM AND REMOTE ANNUNCIATOR:

- A. Provide all wiring, devices, equipment, and components to automatically activate the appropriate signals and initiate the appropriate annunciation as specified herein.
- B. Provide remote annunciator panel in surface enclosure with the features specified and with audible and visual alarm indication of the following conditions:
- C. Low engine temperature (engine heater not functioning).
1. High temperature prealarm - engine temperature approaching shut down.
 2. Low oil pressure prealarm - engine oil pressure approaching shut down.
 3. Unit shut down due to low oil pressure.
 4. Unit shut down due to high temperature.
 5. Unit shut down due to overcrank.
 6. Unit shut down due to overspeed.
 7. Emergency (or normal) power source supplying load.
 8. Battery charger malfunction.

9. Low fuel - main tank contains less than a 3 hour supply.
 10. Low battery voltage.
 11. System ready no alarm conditions present, all controls in "automatic".
 12. Audible alarm silence push button.
- D. MANUFACTURER: Subject to compliance with requirements, provide engine-driven generator sets of one of the following:
1. Caterpillar Tractor Co.
 2. Kohler Co.
 3. Onan Corp.

PART 3 – EXECUTION

3.1 INSTALLATION OF ENGINE-GENERATOR SYSTEMS:

- A. Install standby engine-generator sets as indicated, in accordance with the equipment manufacturer's written instructions, and with recognized industry practices, to ensure that engine-generator sets fulfill requirements. Comply with NFPA and NEMA standards pertaining to installation of standby engine-generator systems and accessories.
- B. Provide vibration isolation mounting and anchoring of generator set to concrete slab.
- C. Install fuel oil and piping to standby generator equipment. Comply with manufacturer's instructions and recommendations.
- D. Provide engine lubricating oil, fuel, engine coolant, filters, etc. for system testing. After testing, refill all fluids to capacity (including all fuel tanks furnished under this contract) for final acceptance.

3.2 GROUNDING:

- A. Provide equipment grounding connections for system components.

3.3 TESTING:

- A. Upon completion of installation of engine-generator system and after building circuitry has been energized with normal power source, (including all VFD's and other motor starters), test engine-generator to demonstrate standby capability and compliance with requirements. Provide start-up and testing by factory authorized representative in accordance with manufacturer's recommendations. Provide each of the following tests (as a minimum) and submit written report of results of each as part of the Operation and Maintenance Manuals required herein:
 1. Mimic a normal power outage by de-energizing normal power source to the facility. Verify engine start, transfer, and operation of all loads satisfactorily. Re-energize normal power, and verify proper performance of load retransfer, engine cool down, and engine shut down. Record and

- report all results.
2. Mimic a generator test by operating the "test mode" switch (with facility still energized by normal power). Verify engine start, transfer, and operation of all loads satisfactorily. Return "test" switch to normal, and monitor performance of load retransfer, engine cool down, and engine shut down. Record and report all results.
 3. Perform a safety run test in accordance with the following:
 - a. Provide all fluids, equipment, and test instrumentation to perform complete tests.
 - b. Perform and record all engine manufacturer's recommended pre-starting checks and inspections.
 - c. Verify the proper operation of all controls, gauges, instruments, and set points.
 - d. Verify the proper operation of the emergency stop switch, the over-speed limit switch, oil overfill limit, oil low limit, and the over-and under-frequency limits.
 - e. Perform an engine load run test. Provide all fluids, equipment, load banks, and test instrumentation to perform complete tests.
 4. Perform and record all engine manufacturer's recommended prestarting checks and inspections.
 5. Start and operate engine for 2 hours at 75% of rated load. Increase load to 100 % of rated load and operate for 1 hour. Increase load to 110% of rated load and operate for 1 hour. Decrease load to 100 % of rated load and operate until all temperatures have stabilized.
 6. Drop the entire load at once to verify frequency and voltage regulation, stability and transient response. Increase load in steps equal to maximum step load specified and verify frequency and voltage regulation, stability and transient response.
 7. Operate the engine for 30 minutes at 100% rated load and until all temperatures have stabilized. Shut down engine.
 8. Inspect lube oil filter for excessive metal, abrasive foreign particles, etc. If corrective action is necessary, perform all above run tests again after corrections have been made. Check all engine and mounting bolts for tightness and/or visible damage. Inspect and verify engine-generator shaft alignment by means of dial indicator.

3.4 ON SITE TRAINING:

- A. Conduct a training course for operating staff as designated by the Owner. The training period shall consist of a total of 8 hours of normal working time distributed between two shifts, and shall start after the system is functionally complete but prior to final acceptance. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment as well as all major elements of the operation and maintenance manuals. Additionally, the course instruction shall demonstrate all routine maintenance operations such as oil change, oil filter change, air filter change, etc.

3.5 FIELD ENGINEER:

- A. Provide a qualified field engineer to supervise the installation of the engine generator set, transfer and by-pass switches, etc., assist in the performance of the on-site tests, and instruct personnel as to the operational and maintenance features of the equipment.

END OF SECTION 16610

SECTION 16001 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full.

1.2 DESCRIPTION OF WORK:

- A. The extent of electrical work is indicated on drawings and/or specified in Division 16 sections of the specification. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system. Work includes, but is not necessarily limited to, the following items.

| <u>ITEM</u> | <u>SECTION</u> |
|---|----------------|
| 1. Electrical General Provisions | 16001 |
| 2. Electrical Connections for Equipment | 16070 |
| 3. Demolition | 16080 |
| 4. Conduit Raceways | 16110 |
| 5. Conductors and Cables | 16120 |
| 6. Electrical Boxes and Fittings | 16135 |
| 7. Supporting Devices | 16136 |
| 8. Motor Starters | 16155 |
| 9. Motor and Circuit Disconnects | 16170 |
| 10. Overcurrent Protective Devices | 16180 |
| 11. Grounding | 16452 |
| 12. Emergency Electrical Systems | 16610 |

- B. Use of standard industry symbols together with the special symbols, notes, and instructions indicated on the drawings describe the work, materials, apparatus and systems required as a portion of this work.
- C. Visit the site during the bidding period to determine existing conditions affecting electrical and other work. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.3 DEFINITION OF TERMS

- A. The following terms used in Division 16 documents are defined as follows:
1. "Provide": Means furnish, install and connect, unless otherwise indicated.
 2. "Furnish": Means purchase and deliver to project site.
 3. "Install": Means to physically install the items in-place.
 4. "Connect": Means make final electrical connections for a complete operating piece of equipment.

1.4 RELATED SECTIONS:

- A. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
- B. General and Supplementary Conditions: Drawings and general provisions of contract and Division 1 of the Specifications, apply to all Division 16 sections.
- C. Earthwork:
1. Provide trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, buried cable, in-grade pull boxes, manholes, lighting pole foundations, etc. See Division 2, Sitework, and other portions of Division 16, for material and installation requirements.
- D. Concrete Work:
1. Provide forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting as required for under ground conduit encasement, light pole foundations, pull box slabs, vaults, equipment pads, etc. See Division 3, Concrete for material and installation requirements.
- E. Miscellaneous Metal Work:
1. Provide fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor controls centers, etc. See Division 5, Metals for material and installation requirements.
- F. Miscellaneous Lumber and Framing Work:
1. Provide wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment. See Division 6, Rough Carpentry for material and installation requirements.
- G. Moisture Protection:
1. Provide membrane clamps, sheet metal flashing, counter flashing, caulking and sealants as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors and ceiling slabs and foundation walls. All penetrations through vapor barriers

at slabs on grade shall be taped and made vaportight. See Division 7, Thermal and Moisture Protection for material and installation requirements.

H. Access panels and doors:

1. Provide in walls, ceiling, and floors for access to electrical devices and equipment. See Division 8, Doors and Windows for material and installation requirements.

I. Painting:

1. Provide surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, poles, surface metal raceways, etc. See Division 9, Finishes for material and installation requirements.

1.5 WORK FURNISHED AND INSTALLED UNDER ANOTHER SECTION REQUIRING CONNECTIONS UNDER THIS SECTION:

- A. Provide electrical service, make requisite connections and perform operational test. Items furnished and installed under other sections and connected under this section, include but are not limited to the following:
1. Electric motors.
 2. Package mechanical equipment: pumps, etc.
 3. Flow switches and valve monitors.

1.6 WORK NOT INCLUDED IN THIS DIVISION:

- A. Items of work provided under another contract include, but are not necessarily limited to, the following:
1. Control wiring both line and low voltage for items not provided under this division.

1.7 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS:

- A. Before bidding, Contractor shall familiarize himself with the drawings, specifications and project site. Submit requests for clarification to Architect/Engineer in writing prior to issuance of final addendum. After signing the contract, the Contractor shall meet the intent, purpose, and function of the Contract Documents. Any costs of materials, labor and equipment arising therefrom, to make each system complete and operable, is the responsibility of the Contractor.

1.8 QUALITY ASSURANCE:

- A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refers to the latest

edition of such publications adopted and published prior to submittal of the bid proposed, unless noted otherwise herein. Such codes or standards are considered a part of this specification as though fully repeated herein.

- B. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the Drawings and Specifications. Perform work in accordance with applicable requirements of all governing codes, rules and regulations including the following minimum standards, whether statutory or not:
1. National Electric Code (NEC).
 2. International Building Code (IBC).
 3. International Fire Code (IFC).
 4. International Mechanical Code (IMC).
- C. Standards: Comply with the following standards where applicable for equipment and materials specified under this Division.
- | | | |
|----|-------|--|
| 1. | UL | Underwriters' Laboratories |
| 2. | ASTM | American Society for Testing Materials |
| 3. | CBN | Certified Ballast Manufacturers |
| 4. | IPCEA | Insulated Power Cable Engineers Association |
| 5. | NEMA | National Electrical Manufacturer's Association |
| 6. | ANSI | American National Standards Institute |
| 7. | ETL | Electrical Testing Laboratories |
- D. All electrical apparatus furnished under this Section shall conform to (NEMA) standards and the NEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.
- E. Comply with requirements of State and Local Ordinances. If a conflict occurs between these requirements and the Contract Documents, the most stringent requirements shall govern. The Contractor accepts this responsibility upon submitting his bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the Contractor from complying with any requirements of the Contract Documents which may be in excess of the aforementioned requirements, and not contrary to same.
- F. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Furnish a certificate of approval to the Owner's Representative from the Inspection Authority at completion of the work.
- G. Employ only qualified craftsmen with at least three years of experience. Workmanship shall be neat, have a good mechanical appearance and conform to best electrical construction practices. Provide a competent superintendent to direct the work at all times. Any person found incompetent shall be discharged from the project and replaced by satisfactory personnel.

- H. Contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.9 SUBMITTALS:

A. SHOP DRAWINGS AND PRODUCT DATA:

1. After the Contract is awarded but prior to manufacture or installation of any equipment, prepare complete Shop Drawings and Brochures for materials and equipment as required by each section of the specification. Submit 8 complete sets for review. All sets of shop drawing material shall be bound. Prior to submission of the Shop Drawings and Project Data, review and certify that they are in compliance with the Contract Documents. Verify all dimensional information to insure proper clearance for installation of equipment. Check all materials and equipment after arrival on the job site and verify compliance with the Contract Documents. A minimum period of two weeks, exclusive of transmittal time, will be required each time Shop Drawing and/or Brochure is submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling submittal data. If the shop drawings are rejected twice, the contractor shall reimburse the engineer the sum of \$200.00 for the third review and any additional reviews required.
2. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. It shall be clearly understood that the noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Document's shall govern and are not waived, or superseded in any way by the review of the Shop Drawings and Brochures.
3. Certifications shall be written or in the form of rubber stamp impressions as follows:
4. I hereby certify that this Shop Drawing and/or Brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Drawings and Specifications for this Project.

(Name of Electrical Subcontractor)

Signed_____.

Position_____ Date

5. Observe the following rules when submitting the Shop Drawings and Brochures.
 - a. Each Shop Drawing shall indicate in the lower right hand corner, and each Brochure shall indicate on the front cover the following: Title of the sheet or brochure, name and location of the building; names of the Architect and Electrical Engineer, Contractor, Subcontractors, Manufacturer, Supplier/Vendor, etc., date of submittal, and the date of correction and revision. Unless the above information is included the submittal will be returned for resubmittal.
 - b. Shop Drawings shall be done in an easily legible scale and shall contain sufficient plans, elevations, sections, and isometrics to clearly describe the equipment or apparatus, and its location. Drawings shall be prepared by an Engineer/Draftsmen skilled in this type of work. Shop Drawings shall be drawn to at least 1/4" = 1'0" scale.
 - c. Brochures to be submitted shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs which describe several different items in addition to those items to be used, unless all irrelevant information is marked out, or unless relevant information is clearly marked. Brochures from each manufacturer shall be identified and submitted separately.

1.10 OPERATION AND MAINTENANCE MANUALS:

- A. Provide operating instruction and maintenance data books for all equipment and materials furnished under this Division.
- B. Submit four copies of operating and maintenance data books for review at least four weeks before final review of the project. Assemble all data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item. The binder (sized to the material) shall be a 2" slide lock unit (Wilson-Jones B3-367-44). The cover shall be engraved with the job title in 1/2" high letters and the name and address of the Contractor in 1/4" high letters. Provide the same information in 1/8" letters on the spine.
- C. Include complete cleaning and servicing data compiled in clearly and easily understandable form. Show serial numbers of each piece of equipment, complete lists of replacement parts, motor ratings, etc. Each unit shall have its own individual sheet. (Example: If two items of equipment A and D appear on the same sheet, an individual sheet shall be provided for each unit specified).
- D. Include the following information where applicable.

1. Identifying name and mark number.
 2. Certified outline Drawings and Shop Drawings.
 3. Parts lists.
 4. Performance curves and data.
 5. Wiring diagrams.
 6. Light fixture schedule with the lamps and ballast data used on the project for all fixtures
 7. Manufacturer's recommended operating and maintenance instructions.
 8. Vendor's name and address for each item.
- E. The engineer shall review the manuals and when approved, will forward the manuals on to the architect. If the manuals are rejected twice, the contractor shall reimburse the engineer the sum of \$200.00 for each review afterwards.

1.11 RECORD DRAWINGS:

- A. Maintain, on a daily basis, a complete set of "Record Drawings", reflecting an accurate record of work in accordance with the following:
1. Show the complete routing and location of all feeders rated 100 amps and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.)
 2. Show the complete routing and location of all telecommunications conduits, systems raceways, and empty raceways, 1-1/4" and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.).
 3. Show all changes, deviations, addendum items, change orders, job instructions, etc., which change the work from that shown on the contract documents, including wall relocations, fixtures and device changes, branch circuiting changes, etc. Where locations of boxes, raceways, equipment, etc. are adjusted in the field to fit conditions, but such new locations may not be obvious by referring to the contract document, show new locations on the record drawings.
- B. At the discretion of the Architect/Engineer, the drawings will be reviewed on a periodic basis and used as a pre-requisite for progress payments. This requirement shall not be construed as authorization for the Contractor to make changes in the layout, or work without written authorization for such changes. The "Record Drawings" for daily recording shall consist of a set of blue line prints of the Contract Drawings.
- C. Upon completion of the work, purchase a complete set of reproducible mylar sepia drawings with the Architect/Engineer's seal and firm name removed or blacked out. Transfer all "Record" information from the blue line prints to the sepias. The sepias shall be reviewed by the Architect/Engineer and the resulting comments shall be incorporated into the final record sepias by the contractor.

- D. Certify the "Record Drawings" for correctness by placing and signing the following certifications of the first sheet of the sepia:

1. "CERTIFIED CORRECT (3/8" high letters)

(Name of General Contractor)

By _____ Date

(Name of Electrical Contractor)

By _____ Date

1.12 GUARANTEE:

- A. Ensure that electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes. Without additional charge, replace any work or materials which develop defect, except from ordinary wear and tear, within one year from the date of substantial completion. Exception: Incandescent and fluorescent lamps shall be guaranteed for a period of two months from the date of substantial completion.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Products are specified by manufacturer name, description, and/or catalog number. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer who will issue interpretation and/or additional instructions to Bidders before the project is bid.

2.2 MANUFACTURERS:

- A. Provide products of manufacturers specified. Manufacturers catalog numbers and descriptions establish the quality of product required. Substitutions will be considered if a duplicate written application (2-copies) is at the office of the Architect/Engineer eight (8) working days prior to the day of the bidding. The application shall include the following: 1) A statement certifying that the equipment proposed is equal to that specified; that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents; 2) The specified and submittal catalog numbers of the equipment under consideration; 3) A pictorial and specification brochure.

- B. Any conflict arising from the use of substituted equipment shall be the responsibility of the Contractor, who shall bear all costs required to make the equipment comply with the intent of the contract documents.
- C. Samples may be required for non-standard or substituted items before installation during construction. Provide all samples as required.
- D. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued.
- E. Provide only equipment specified in the Contract Documents or approved by addendum.

2.3 SPARE PARTS:

- A. Provide spare parts (fuses, diffusers, lamps, etc.) as specified. Transmit all spare parts to Owner's Representative prior to substantial completion.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Layout electrical work in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary for proper installation; perform with care. Use skilled mechanics of the trades involved. Repair damage to building and equipment at no additional cost to the contract. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting structural members shall not be permitted.
- B. Since the drawings of floor, wall, and ceiling installation are made at small scale; outlets, devices, equipment, etc., are indicated only in their approximate location unless dimensioned. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not scale the electrical drawings, but refer to the architectural and mechanical shop drawings and project drawings for dimensions as applicable.
- C. Perform for other trades, the electrical wiring and connection for all devices, equipment or apparatus. Consult Architectural, Mechanical, and other applicable drawings, and all applicable shop drawings to avoid switches, outlets, and other equipment from being hidden behind doors, cabinets, counters, heating equipment, etc., or from being located in chalkboards, tackboards, glass panels, etc. Relocate buried electrical devices and/or connections as directed at no additional cost.
- D. Coordinate the location of outlets, devices, connections, and equipment with the supplier of the systems furniture prior to rough-in.

- E. Where conduit, outlets or apparatus are to be encased in concrete, it must be located and secured by a journeyman or foreman present at the point of installation. Check locations of the electrical items before and after concrete and/or masonry installation and relocate displaced items.
- F. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

3.2 CLEAN:

- A. Clean up all equipment, conduit, fittings, packing cartons and other debris that is a direct result of the installation of the work of this Division.
- B. Clean fixtures, interiors and exteriors of all equipment, and raceways. Replace all filters in electrical equipment upon request for Substantial Completion.

3.3 POWER OUTAGES:

- A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the Owner. Include all costs for overtime work in bid.
- B. Submit written request at least 7 days in advance of scheduled outage and proceed with outage only after receiving authorization from the Owner's Representative.
- C. Keep all outages to an absolute minimum.

3.4 STORAGE AND PROTECTION OF MATERIALS:

- A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. In no case shall storage interfere with traffic conditions in any public thoroughfare or constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.5 EXCAVATING FOR ELECTRICAL WORK:

- A. General: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling. Perform excavation in a manner which protects walls, footings, and other structural members from being disturbed or damaged in any way. Burial depths must comply with NEC Section 300-5 (or State of Utah requirement, whichever is more stringent), unless noted otherwise on drawings.
- B. Protect persons from injury at excavations, by barricades, warnings and illumination.
- C. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.

- D. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or subbases.
- E. Do not excavate for electrical work until the work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum. See other sections of specification for additional requirements for excavating.
- F. Store excavated material (temporarily) near excavation, in manner which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).
- G. Retain excavated material which complies with requirements for backfill material. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material. Remove unused material from project site, and dispose of in lawful manner.

3.6 BACKFILL MATERIALS:

- A. For buried conduit or cable (other than below slab-on-grade, or concrete encased) - 2" thickness of well graded sand on all side of conduit or cable.
- B. For trench backfill to within 6" of final grade - soil material suitable for compacting to required densities.
- C. For top 6" of excavation - Top soil.
- D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.
 - 1. Lawn/Landscaped Areas: 85 percent for cohesive soils, 95 percent for cohesionless soils.
 - 2. Paved Areas, Other than Roadways (90 percent for cohesive soils, 95 percent for cohesionless soils).
- E. Subsidence: Where subsidence is measurable or observable at electrical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality and condition of the surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.7 CONCRETE BASES:

- A. Unless otherwise noted, provide 4" high reinforced concrete bases for all floor mounted or floor standing electrical equipment, including generators, transformers, switchgear, battery racks, motor control centers, etc. Extend bases 6" beyond equipment or mounting rails on all sides or as shown on the drawings. Notwithstanding this requirement, coordinate with equipment manufacturer, shop drawings, and height of base to ensure compliance with NEC 404.8.
- B. Concrete bases shall be provided under Division-16. Coordinate size and location of all bases and furnish all required anchor bolts, sleeves, reinforcing and templates as required to obtain a proper installation.
- C. Provide and locate properly sized concrete pads for power company furnished pad mounted transformers in accordance with power company clearance requirements. Where the serving utility is Utah Power, the electrical contractor shall conform to the requirements of Electrical Service Requirements, Section 6.4.

3.8 FIRE PENETRATION SEALS:

- A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. The fire rating of the penetration seal shall be at least that of the floor, wall or ceiling into which it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs, and similar structures. Where applicable, provide 3M fire barrier sealing penetration system, and/or IPC Flame Safe Fire Stop System, and/or Chase Foam fire stop system, including wall wrap, partitions, caps, and other accessories as required. All materials to comply with UL 1479 (ASTM E-814). Comply with manufacturer's instructions and recommendations for installation of sealing fittings and barrier sealing systems.

3.9 PROJECT FINALIZATION AND START-UP:

- A. Upon completion of equipment and system installation, assemble all equipment Factory Representatives and Subcontractors for system start-up.
- B. Each Representative and Subcontractor shall assist in start-up and check out their respective system and remain at the site until the total system operation is accepted by the Owner's representative.
- C. The Factory Representative and/or System Subcontractor shall give personal instruction on operating and maintenance of their equipment to the Owner's maintenance and/or operation personnel. To certify acceptance of operation and instruction by the Owner's Representative, the contractor shall prepare a written statement as follows:

D. This is to certify that the Factory Representative and System Subcontractor for each of the systems listed below have performed start-up and final check out of their respective systems.

E. The Owner's Representative has received complete and thorough instruction in the operation and maintenance of each system.

1. SYSTEM

(List systems included)

FACTORY REPRESENTATIVE

(List name and address of
Factory Representative).

Owner's Representative

Contractor

F. Send copy of acceptance to Architect/Engineer.

3.10 FINAL REVIEW:

A. At the time of final review, the project foreman shall accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested, to allow review of the entire electrical system.

END OF SECTION 16001